HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Cowlitz River Summer Steelhead (Segregated)
Species or Hatchery Stock:	Summer Steelhead (*Oncorhynchus mykiss*) Cowlitz Trout Hatchery
Agency/Operator:	Washington Department of Fish and Wildlife Tacoma Power
Watershed and Region:	Cowlitz River/Lower Columbia
Date Submitted:	
Date Last Updated:	August 29, 2014

This page intentionally left blank

Executive Summary

The Washington Department of Fish and Wildlife is submitting a Hatchery and Genetic Management Plan (HGMP) for the Cowlitz River Summer (early) Steelhead program to the National Marine Fisheries (NMFS) for consultation under Section 10(a)(1)(A) or 4(d) of the Endangered Species Act (ESA). NMFS will use the information in this HGMP to evaluate the hatchery impacts on salmon and steelhead listed under the ESA. The primary goal of an HGMP is to devise biologically-based hatchery management strategies that ensure the conservation and recovery of salmon and steelhead populations. This HGMP focuses on the implementation of hatchery reform actions adopted by the Washington Fish and Wildlife Commission Policy on Hatchery and Fishery Reform C-3619.

The purpose of the program is to produce Cowlitz River hatchery-origin summer steelhead for sustainable escapement to the watershed, while providing recreational fisheries under mark-selective fishery regulations. Program fish will be produced at the Cowlitz Hatchery Complex (Cowlitz Salmon and Cowlitz Trout Hatcheries), on the Cowlitz River (WRIA 26.0002). The program will annually release around 650,000 yearlings to the lower Cowlitz River. The In-season Implementation Tool (ISIT) is used on an annual basis to monitor the program and compliance with Hatchery Scientific Review Group (HSRG) standards.

This hatchery-origin early summer steelhead HGMP is built around the principles and recommendations of the HSRG. These principles and recommendations represent the best science available for operating hatchery facilities consistent with the conservation of salmonid species. The program is operated as a "segregated type" program, as defined by the HSRG. A "segregated" program is one in which only hatchery-origin individuals are used in the hatchery broodstocks. Segregation is achieved by using returning adult hatchery-origin summer steelhead (distinguished by an adipose fin clip) returning to the Cowlitz River at the Cowlitz Salmon Hatchery trap from April through December. All fish released through this hatchery program have been mass-marked (adipose fin-clipped) since 1984.

Lower Columbia River steelhead are listed as "Threatened" under the ESA. However, this stock of early summer steelhead is not included in the DPS.

Broodstock Collection:
The broodstock is derived from hatchery-origin stock returning to the Cowlitz sub-basin. Approximately 200 females are needed to meet the current egg-take goal of 850,000; around 500 females may be collected at the Cowlitz Hatchery Complex to meet run and spawn timing and assure an adequate number of spawners.

Harvest:
Total annual harvest is dependent on management response to annual abundance in *Pacific Salmon Commission* (PSC - U.S./Canada), *Pacific Fishery Management Council* (PFMC - U.S. ocean), and *Columbia River Compact* forums. WDFW has also received authorization for tributary, Columbia River mainstem, and ocean fisheries; the combined harvest rates in the *Fisheries Management and Evaluation Plan* (FMEP), *Columbia River Fish Management Plan* (CRFMP), and ocean fisheries are reviewed annually in the North of Falcon process to ensure the harvest rates are consistent with recovery of the Lower Columbia River Tule Chinook population. The *U.S. v Oregon* Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2008–2017 *U.S. v Oregon* Management Agreement for upriver Chinook, sockeye, steelhead, coho, and white sturgeon" (2008–2017 MA).

Under permanent regulations, the mainstem Columbia River is open to the retention of hatchery steelhead beginning May 16 from the Tongue Point/Rocky Point line upstream to the I-5 Bridge and June 16 from the I-5 Bridge upstream to the Oregon/Washington border above McNary Dam. The steelhead fishery is closed under permanent regulations during April 1–May 15 between Tongue Point and the I-5 Bridge and April 1–June 15 upstream of I-5, when spring Chinook abundance is high.

Due to a lack of coded-wire tag studies and limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) are likely underestimated. Based on the average SAR of 4.50% for brood years 2000-2007, fishery years 2003-2010, and a programmed release goal of 650,000 yearlings, the estimated production goal would be 29,250 adults.

Monitoring and Evaluation:
Performance indicators for harvest will be accomplished by continuing mass-marking (adipose fin-clip). WDFW also plans to implement a genetic monitoring program to measure introgressive hybridization between segregated hatchery steelhead and wild populations.

In addition, temporary fish collection weirs have been installed, and operated on the lower Cowlitz tributaries since 2012. Operation of these weirs allow WDFW to control the number of hatchery summer steelhead reaching natural spawning locations, thereby benefiting natural production in these basins. Additionally, this project funds spawning ground survey activities to monitor the effectiveness of these weirs and allow for the calculation of important hatchery performance metrics, such as pHOS. Deliverables include estimates of pHOS, and trapping efficiency.

Operation and Maintenance of Hatchery Facilities:
WDFW's Cowlitz summer steelhead program uses two facilities. The facility farthest upstream is the Cowlitz Salmon Hatchery, which draws water from multiple sources: wells with a water right of 4,920 gpm; and an intake on the Cowlitz River, with a water right of 200 cfs. Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). Tacoma Power is investigating the intake to see if reasonable measures could result in improvements. The Cowlitz Salmon Hatchery operates under the *"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System* (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). Cowlitz Trout Hatchery has multiple water sources: 4,861 gpm water right from nine wells and a river intake with a water right of 56 cfs and an ozone plant capable of treating up to 20 cfs.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Cowlitz River Summer Steelhead

1.2 Species and population (or stock) under propagation, and ESA status.

Cowlitz Trout Hatchery Summer Steelhead (*Oncorhynchus mykiss*)

ESA Status: Not listed. Early summer steelhead of hatchery-origin propagated in this program are not part of the listed Lower Columbia River steelhead DPS (NMFS January 5, 2006, 71FR834).

1.3 Responsible organization and individuals

Hatchery Operations Staff Lead Contact

Name (and title): Mark Johnson, Hatcheries Operations and Complex Manager
Agency or Tribe: Washington Department of Fish & Wildlife
Address: 165 Osprey Lane, Toledo WA 98591
Telephone: (360) 864-6135
Fax: (360) 864-6122
Email: Mark.Johnson@dfw.wa.gov

Fish Management Staff Lead Contact

Name (and title): Eric Kinne, Region 5 Hatchery Reform Coordinator
Agency or Tribe: Washington Dept. of Fish and Wildlife
Address: 2108 Grand Boulevard, Mail Stop: S-19, Vancouver, WA 98661-4624
Telephone: (360) 906-6747
Fax: (360) 906-6776
Email: Eric.Kinne@dfw.wa.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Tacoma Power - Funding Source and Cowlitz Trout Hatchery Facility Owner

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources	Operational Information
Tacoma Power	Full time equivalent staff – 8.6
	Annual operating cost (dollars) - $1,262,865

The above information for full-time equivalent staff and annual operating cost applies cumulatively and cannot be broken out specifically by program.

1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: Cowlitz River hatchery-origin early summer steelhead

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Cowlitz Salmon Hatchery	Broodstock collection, adult holding/spawning, incubation and early rearing.	Located on the Cowlitz River (WRIA 26.0002) at RKm 79.0, tributary to the Columbia River at RKm 109.4 Lower Columbia River, Washington.
Cowlitz Trout Hatchery	Rearing and release.	Located on the Cowlitz River (WRIA 26.0002) at RKm 66.0, tributary to the Columbia River at RKm 109.4 Lower Columbia River, Washington.

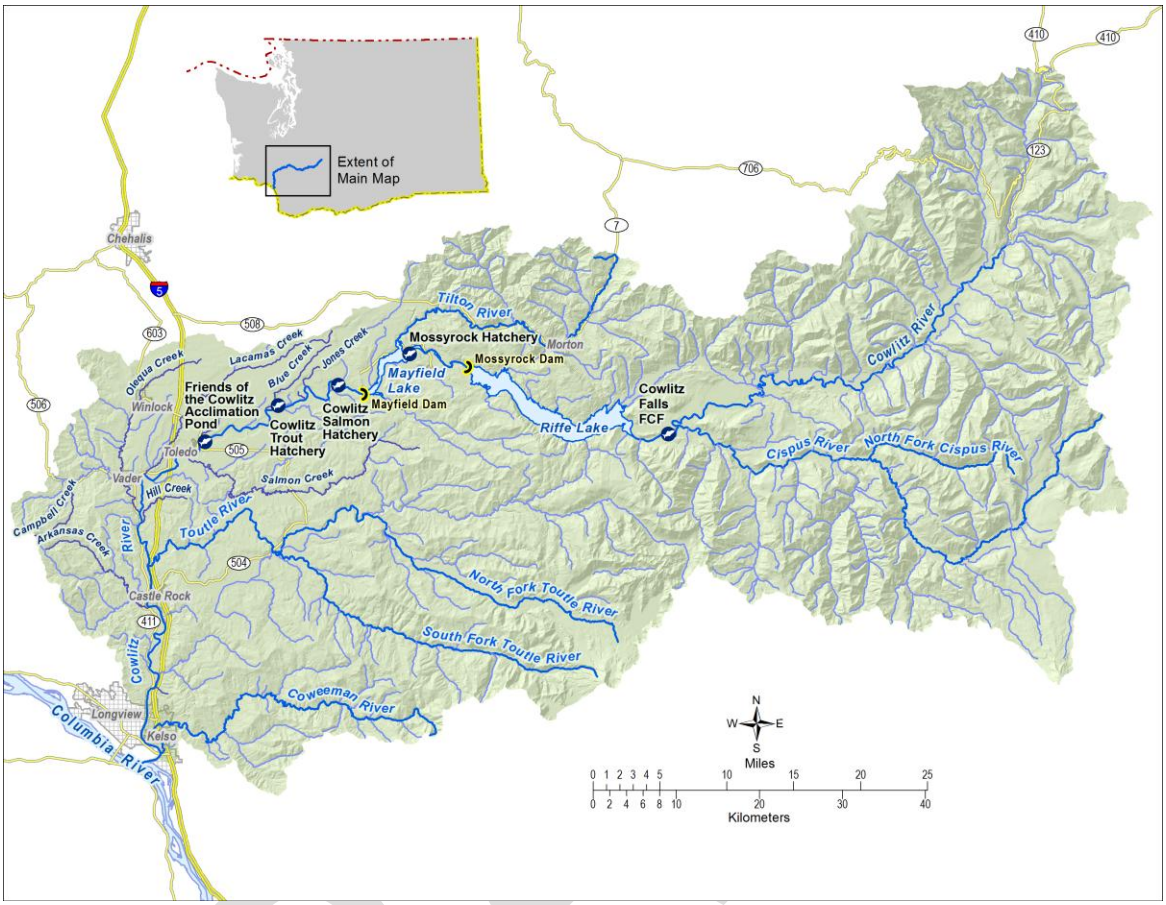


Figure 1.5.1: Cowlitz Hatchery Complex Facilities. Source: WDFW GIS 2014.

1.6 Type of program.

Segregated Harvest

1.7 Purpose (Goal) of program.

Mitigation/Augmentation. The goal of this program is to maximize sport harvest under the selective fishery regulations (retention of adipose-clipped fish only) while eliminating a directed harvest on wild steelhead. Also serves as mitigation for hydro-system development and habitat loss. The harvest goal for this program is 10,000 to 20,000 fish in the lower Cowlitz per the *Fisheries and Hatchery Management Plan* (FHMP update 2011).

1.8 Justification for the program.

Both current and future lower and upper Cowlitz River production are described by the FHMP (update 2011) submitted by Tacoma Power for the Cowlitz River Hydroelectric Project. WDFW will continue to run the program as a segregated stock, consistent with the FHMP proposal to operate hatchery production for rearing salmonids native to the Cowlitz River as integrated programs, and all non-native species a segregated program (FHMP update 2011). This early summer steelhead stock is not endemic to the Cowlitz River with the broodstock originally from the Skamania Hatchery (a mixture of Washougal and Klickitat River summer steelhead). The hatchery stock has been self-sustaining in the Cowlitz basin since the program began. The program is managed for early spawn timing, heavy harvest opportunity and prevents fish from accessing the upper basin. The program utilizes stock derived from hatchery-origin adults returning to the Cowlitz Barrier Dam and the size of the program has been tailored to meet harvest objectives, based on the Cowlitz Hydroelectric re-licensing process and research/M&E activities (FERC-2016).

Hatchery-origin early summer steelhead are released 100% mass-marked (adipose fin-clip), allowing hatchery staff to differentiate between hatchery- and natural-origin fish returning to the Cowlitz Hatchery Complex. The Barrier Dam located below Mayfield Dam prevents these early summer steelhead from accessing stream reaches above this point.

WDFW has implemented restrictive regulations permitting the retention of marked adult hatchery-origin steelhead only and requiring the release of naturally produced adult steelhead (WDFW 2003a). All hatchery-origin steelhead released in the action area are externally marked with an adipose fin-clip to allow for these selective fisheries. WDFW (2003a) will manage the tributary harvest of summer and winter steelhead stocks in the action area not to exceed a maximum harvest rate of 10% of the natural spawning population, although the actual impacts are expected to be closer to 5% (WDFW 2003a). The program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish.

In order to minimize impacts on listed fish by WDFW facilities operation and the Cowlitz River early summer steelhead program, the following Risk Aversions are included in this HGMP.

Table 1.8.1: Summary of risk aversion measures for the Cowlitz River early summer steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water rights are formalized through trust water rights from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but does not meet the current *Anadromous Salmonid Passage Facility Design* criteria (NOAA-NMFS 2011).
Effluent Discharge	4.2	These facilities operate under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) administered by the Washington Department of Ecology (DOE) WAG 13-1021 and WAG 13-1034.
Broodstock Collection & Adult Passage	7.9	Facilities follow WDFW broodstock collection and sorting protocols; any non-target listed fish can be quickly identified and, if encountered, are released back to the stream to minimize impacts.
Disease Transmission	2.2.3, 7.9, 10.11	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) and the *Fish Health Policy in the Columbia Basin* details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released as smolted yearlings that emigrate from the system and Columbia river within the year of release. Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

1.9 List of program "Performance Standards".

See HGMP section 1.10. Performance Standards below pertain to the hatchery production at Cowlitz Salmon and Trout Hatcheries only and do not contain complete indicators for the upriver reintroduction program. For further information on upriver performance indicators and standards, refer to the FHMP (update 2011).

1.10 List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.2 Program contributes to mitigation requirements. Program provides mitigation for lost fish production due to development within the Columbia River Basin and contributes to sport and commercial fisheries (Columbia River Fish Management Plan, *U.S. v Oregon*, FERC).	Number of fish released by program returning, or caught, as applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. Fry/fingerling releases consistent with the Fisheries Technical Committee (FTC) and FHMP goals. This program provides mitigation for lost fish production due to hydro-power development within the Cowlitz system; contributes to estuary sport and lower Cowlitz river sport fisheries.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Annual number of fish produced by program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery steelhead releases to differentiate hatchery from natural-origin fish and record estimates of mark rate. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Agencies monitor harvests and hatchery returns to provide up-to-date information. Estimate survival and contribution to fisheries for each brood year released.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults. Percentage of total hatchery releases mass-marked (fin clips, otoliths, tags, etc., depending on species) to allow for their	Annually monitor and report size, number, date, location and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Annually sample returning fish for the adipose fin-clip in fisheries and at the hatchery; record numbers of estimated

	differentiation from naturally-produced fish as returning adults.	hatchery (marked) and natural (unmarked) fish. This program was modelled to meet HSRG standards for pHOS using the ISIT tool. Program is reviewed annually.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal distribution of broodstock collection at point of collection.	Collect broodstock representatively and systematically throughout the early portion of the return (July through September). Collect annual run timing, age and sex composition and spawning escapement timing data. Adhere to WDFW spawning guidelines (Seidel 1983; HSRG 2009).
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish.	Smoltification status (size fpp/mass CV and condition factor) and behavior are monitored in the hatchery. Yearling fish released at 5.5 fpp.	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and record size, number, and date of release.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for conservation goals.	Monitor harvests and hatchery returns throughout the run.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually record growth rates, mark rate and size at release and release dates. Adhere to HSRG (2009) and WDFW spawning guidelines (Seidel 1983). See also HGMP section 11 for program monitoring and evaluation.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Long-term monitoring of system population will indicate success of program.
	Provide information about agency programs and hatchery operations to such internal and external audiences as local schools and special interest groups. Off station efforts may include festivals, classroom participation, stream adoptions	Record on-station organized education and outreach events. Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.

	and fairs.	

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science hatchery management actions. Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults on the spawning ground. Production fish are mass-marked (adipose fin-clip) to allow for their differentiation from naturally-produced fish	Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement. Harvest is regulated to meet appropriate biological assessment criteria. Agencies monitor harvests and hatchery escapements to provide up-to-date information.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	Annually monitor and report mass-mark type, quality and rates. Assess annual harvest of mass-marked hatchery fish based on CWT recovery estimates and creel surveys (see HGMP section 3.3.1).
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs.	Annually monitor and report size, number, date, location and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Examine returning fish encountered for the mass-mark (CWT) at the hatchery and on the spawning ground. Annually record numbers of estimated hatchery (marked) and natural (unmarked). This program was modelled to

		meet HSRG standards for pHOS using the ISIT tool. Program is reviewed annually.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect annual run timing, age and sex composition and return timing data.
3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Number of spawners of natural-origin removed for broodstock.	Trap is checked daily. Non-target listed fish, when encountered, are returned to the river.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not affected by artificial production.	Conduct genetic monitoring of the hatchery and natural populations (see HGMP section 11.1).
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing.	All hatchery production is identifiable in some manner (fin-marks, tags, etc.). Collect annual run timing, origin, and age and sex composition data. Examine returning fish for the mass-mark (adipose fin-clip) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually record and report release information, including location, method and age class in hatchery data systems (WDFW Hatcheries Headquarters Database).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Annually monitor and record size, number, date of release and release type.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State*).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. Washington Department of Ecology (WDOE) water right permit compliance.	Flow and discharge reported in monthly NPDES reports.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, revised 2006).	Necropsies of fish to assess health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, all females are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below broodstock collection site is currently compared to historic	Not monitored at this time.

	distribution.	
3.7.7 Weir/trapping operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Traps checked daily. Annually record and report abundances and observations of natural-origin fish at hatchery facilities.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally produced Chinook (Sharpe et al. 2008, Topping and Zimmerman 2011)

1.11 Expected size of program.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

Approximately 200 females are needed to meet the program egg-take goal (850,000 FBD 2014). Fecundity is approximately 4,200 eggs/female. An approximate total of 500 females are collected to meet run and spawn timing and assure an adequate number of spawners.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Table 1.11.2.1: Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Size (fpp)	Release Date	Location		
				Stream	Release Point (RKm)	Major Watershed
Yearling	650,000	5.5	Apr - May	Lower Cowlitz	78.9	Cowlitz

Source: Future Brood Document 2014.

Note: Net pen releases from Friends of the Cowlitz (FOC) enhancement programs (Toledo Sand and Gravel Pond) at RKm 41.1 were discontinued in 2012.

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Early summer hatchery-origin steelhead stocks have been planted into the Cowlitz River since 1968 to provide both a sport fishery, and enough escapement to the hatchery to maintain the program. Broodstock from 1972 and subsequent releases were collected on the Cowlitz River. Harvest has increased since 1999, in part due to larger plants and better ocean survival which indicates significant program success at the 500,000 – 600,000 plant level **(Table 1.12.1)**.

Table 1.12.1: Returns of Summer Steelhead to Cowlitz Salmon (CSH) and Trout (CTH) Hatcheries 2001-2012.

Return Year	Returns to Hatchery	
	CSH	CTH
2001	2,223	2,064
2002	1,877	3,664
2003	8,162	3,417
2004	3,180	4,898
2005	8,863	4,308
2006	3,659	1,313
2007	8,987	1,534
2008	1,859	888
2009	6,874	1,626

2010	5,171	1,041
2011	8,355	605
2012	7,052	-
Average	**5522**	**2305**

Source: WDFW Hatcheries Headquarters Database 2014.

For SAR calculation see also **Table 3.3.1.1**.

1.13 Date program started (years in operation), or is expected to start.

This hatchery began operations in 1967; early summer steelhead were first planted into the Cowlitz River in spring 1968 using Skamania stock. Skamania stock plants were made in the Toutle River in 1966.

1.14 Expected duration of program.

Early summer steelhead production from Cowlitz Salmon and Trout Hatcheries is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, operated under the new license with an effective date of July 18, 2003. The license is for a term of 35 years and expires July 18, 2038.

1.15 Watersheds targeted by program.

Cowlitz (WRIA 26.0002)/Lower Columbia River

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues.

The key issues of the early summer steelhead program in regards to ESA-listed fish are the impacts of hatchery smolts on lower river native Chinook, coho, chum and steelhead. For hatchery steelhead, predation, disease and competition along with genetic introgression are impacts on the listed fish. Handling of listed fish occurs during adult collection at the Cowlitz Salmon Hatchery separator unit were both hatchery and wild fish are collected, sorted, held and distributed to any number of programs scenarios including upper river adult reintroduction (FHMP update 2011). The program releases yearling smolts at a time, size and condition factor per WDFW *Steelhead Rearing Guidelines* (Tipping 2001). The steelhead guidelines indicate the weight, length frequency and condition factors at release that results in rapid emigration behavior and minimizes residualism. All releases are made below the Cowlitz River Barrier Dam downstream of the Tilton River/Lake Mayfield system and the Upper Cowlitz system above Lake Scanewa. Significant reintroduction and recovery programs for fall and spring Chinook and coho salmon along with late winter steelhead and anadromous coastal cutthroat have been ongoing in those areas since 1996.

Adults are trapped and differentiated at Cowlitz Salmon Hatchery (CSH) and are spawned, incubated and early rearing of fry on the Recirculation Systems A&B. Rearing of fingerlings to smolt takes place at Cowlitz Trout Hatchery (CTH). Returning hatchery-origin steelhead that are trapped at the Barrier Dam are used for brood stock production, anything above hatchery needs is surplused to the food bank or recycled. Returning wild steelhead are returned to stream of their destined system as per the FHMP.

WDFW continues to consider the alternatives listed in HGMP section 1.16.2. Modeling completed during the development of the C&SF plan indicates this program is currently meeting HSRG and the SSMP standards. WDFW will evaluate the value of implementing alternatives to the existing programs based on information from the LCR regional watershed planning process, data collected as part of the improved monitoring program and results from the study design (currently in development) to estimate gene flow/introgression (HGMP section 11).

1.16.2 Potential Alternatives to the Current Program

Alternative 1: *Eliminate the program*. This action would eliminate potential interaction with the natural population and eliminate impacts on other ESA-listed species. This alternative is not considered acceptable; currently this program supports a very popular sport fishery and significant economic benefits statewide and the Lower Columbia River region. If the program was eliminated, the goals of the Cowlitz Basin Fish Management Plan (WDFW) (see HGMP section 3.2), Cowlitz *Fisheries and Hatchery Management Plan* (update 2011) and Settlement Agreement (FERC-2016 2000) would not be met. Thousands of hours of bank fishing would be eliminated from May – October of the year as well as significant personal boating and guide trips throughout the same period. Pressure would be shifted to other rivers less capable of sustaining the fishing effort.

Alternative 2: *Retain current production.* Continue to manage the Lower Cowlitz River system as one of the largest summer steelhead producers in the state. The large size of the Cowlitz River is conducive to large boats for guide trips and significant access is still available to bank anglers at release points and other locations. Minimum summer and fall flows are managed by Tacoma Power to provide sufficient flows throughout the summer and early fall when other rivers can suffer low flow periods which eliminates most steelhead angling. Depending on the size of the spring Chinook run, summer steelhead provides the bulk of harvest and recreational opportunity from May until early fall when fall Chinook or coho runs materialize. Potential risks to listed species in the system due to indirect impacts including predation, competition, disease and genetic introgression would remain at current levels.

1.16.3 Potential Reforms and Investments.

Reform/Investment 1: *Eliminate the program.* There would be negative region-wide impacts to eliminating the program. Angling restrictions would likely become more restrictive to protect any wild summer run fish in the Cowlitz system or in other neighboring systems due to the increase in pressure. Evaluating the impact would require funding.

Reform/Investment 2: Monitoring and evaluation. Monitor the interaction, production, and the carrying capacity of listed species in these tributaries.

2 SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1 List all ESA permits or authorizations in hand for the hatchery program.

None currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d), or 10.

2.2 Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1 Description of NMFS ESA-listed salmonid population(s) affected by the program.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

None directly – this is a segregated program.

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River steelhead (*Oncorhynchus mykiss*). Listed as a threatened species on March 19, 1998 (63FR13347); threatened status reaffirmed on January 5, 2006 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Lower Columbia River Chinook (*Oncorhynchus tshawytscha*). Listed as "threatened" on March 24, 1999 (64FR14308); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Lower Columbia River coho (*Oncorhynchus kisutch*). Identified as a candidate species on June 25, 1995 (60FR38011). Listed as threatened on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Columbia River chum salmon (*Oncorhynchus keta*). Listed as threatened on March 25, 1999 (64FR14507); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

2.2.2 Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Lower Columbia River Chinook: In Washington, the LCR Chinook ESU includes all naturally spawned Chinook populations from the mouth of the Columbia to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, as well as fifteen artificial propagation programs. Excluded are Upper Columbia River bright hatchery stocks that spawn in the mainstem Columbia River below Bonneville Dam and in other tributaries upstream from the Sandy River to the Hood and White Salmon rivers (NMFS 2014 79FR20802). Spring Chinook were present historically in the Cowlitz, Kalama, Hood, White Salmon and Lewis rivers.

Status: Today only two of 32 historical populations – the North Fork Lewis and Sandy late-fall populations – are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years, and some populations are extirpated, or nearly so. Five of the six strata fall significantly short of the Willamette- Lower Columbia Technical Recovery Team (WLC TRT) criteria for viability. One stratum – Cascade late fall – meets the WLC TRT criteria (Dornbush and Sihler 2013). Dam construction eliminated habitat for a number of populations leading to the extirpation of spring Chinook salmon populations in the Upper Cowlitz, Cispus, Tilton, North Fork Lewis , Big White Salmon rivers, and fall Chinook populations in the Upper Cowlitz and Big White Salmon rivers (SHIEER, NMFS 2004). Projects to allow access have been initiated in the Cowlitz and Lewis systems but these are not close to producing self-sustaining populations; Condit Dam on the Big White Salmon River was breached October 26, 2011. Based on the 2010 recovery plan analyses, all of the 14 Tule populations (**Table 2.2.2.1**) are considered very high risk except one that is considered at high risk. The modeling conducted in association with Tule harvest management suggests that three of the populations (Coweeman, Lewis and Washougal) are at a somewhat lower risk (LCFRB 2010).

Table 2.2.2.1: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River Chinook populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Fall										
Grays/Chinook	Contributing[2]	VL	H	VL	VL[2]	M+	+500%	800	<50	1,000
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	+150%	3,000	<50	1,500
Mill/Aber/Germ	Primary[1]	VL	H	L	VL[2]	H	+155%	2,500	50	900
Youngs Bay (OR)	Stabilizing	--[3]	--[3]	--[3]	L	L	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Contributing[1]	--[3]	--[3]	--[3]	VL	L	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	L	H	--[3]	--[3]	--[3]	--[3]
Cascade Fall										
Lower Cowlitz [C]	Contributing	VL	H	M	VL[2]	M+	+50%	24,000	500	3,000
Upper Cowlitz	Stabilizing	VL	VL	M	VL	VL	--	28,000	0	--
Toutle[C]	Primary[1]	VL	H	M	VL[2]	H+	+265%	11,000	<50	4,000
Coweeman [G]	Primary	VL	H	H	VL[2]	H+	+80%	3,500	100	900
Kalama	Contributing[2]	VL	H	M	VL[2]	M	+110%	2,700	<50	500
Lewis [G]	Primary	VL	H	H	VL[2]	H+	+280%	2,600	<50	1,500
Salmon	Stabilizing	VL	H	M	VL	VL	--	n/a	<50	--
Washougal	Primary	VL	H	M	VL[2]	H+	+190%	2,600	<50	1,200
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Contributing[1]	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Cascade L Fall										
Lewis NF [C,G]	Primary	VH	H	H	VH[1]	VH	0%	23,000	7,300	7,300
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Cascade Spring										
Upper Cowlitz [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	22,000	300	1,800
Cispus [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	7,800	150	1,800
Tilton	Stabilizing	VL	VL	VL	VL	VL	0%	5,400	<100	--
Toutle	Contributing	VL	H	L	VL	M	>500%	3,100	100	1,100
Kalama	Contributing[2]	VL	H	L	VL	L	>500%	4,900	100	300
Lewis NF [C]	Primary	VL	L	M	VL	H	>500%	15,700	300	1,500
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Fall										
L. Gorge (WA/OR)	Contributing	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
U. Gorge (WA/OR) [C]	Contributing[1]	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
White Salmon [C]	Contributing	VL	L	L	VL	M	>500%	n/a	<50	500
Hood (OR)	Primary[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge Spring										
White Salmon [C]	Contributing	VL	VL	VL	VL	L+	>500%	n/a	<50	500
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	VH	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

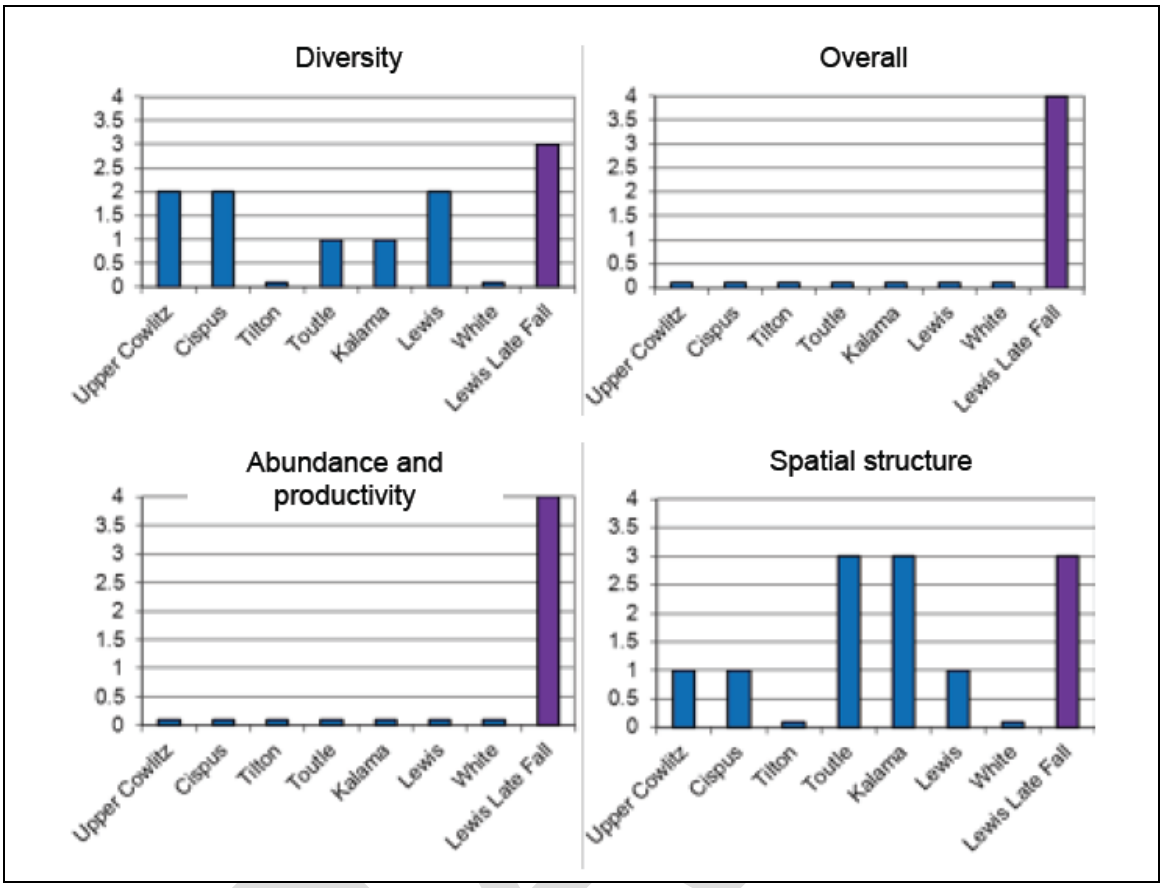


Figure 2.2.2.1: Current status of Washington lower Columbia River spring Chinook and late fall-run (bright) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River Steelhead *(Oncorhynchus mykiss)*: The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), and excludes fish originating from the upper Willamette River Basin above Willamette Falls. The DPS includes seven artificial propagation programs, including the Cowlitz Trout Hatchery Winter-late (Lower Cowlitz), Kalama River Wild (winter- and summer-run) and Lewis River Wild Winter (NMFS 2014 79FR20802).

Status: Today, 16 of the 23 Lower Columbia River steelhead populations have a low or very low probability of persisting over the next 100 years, and six populations have a moderate probability of persistence. Only the summer-run Wind population is considered viable. All four strata in the DPS fall short of the WLC TRT criteria for viability (Dornbush and Sihler 2013). Populations in the upper Lewis and Cowlitz watersheds remain cut-off from access to essential spawning habitat by hydroelectric dams. Projects to allow access have been initiated in the Cowlitz and Lewis systems but these have not yet produced self-sustaining populations (Ford 2011). Condit Dam on the White Salmon River was breached October 26, 2011. WDFW is currently developing watershed-specific management plans in accordance with the SSMP. As part of this planning process, WDFW is proposing to complete a thorough review of current steelhead stock status using the most up to date estimates of adult abundance, juvenile production and genetic information.

Table 2.2.2.2: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River steelhead populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Winter										
Grays/Chinook	Primary	VH	VH	M	M[1]	H	0%[4]	1,600	800	800
Eloch/Skam	Contributing	VH	VH	M	M[1]	M+	0%[4]	1,100	600	600
Mill/Ab/Germ	Primary	H	VH	M	M[1]	H	0%[4]	900	500	500
Youngs Bay (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Big Creek (OR)	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Cascade Winter										
Lower Cowlitz	Contributing	L	M	M	L	M	+5%	1,400	350	400
Upper Cowlitz [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,400	<50	500
Cispus [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,500	<50	500
Tilton	Contributing	VL	M	M	VL	L	>500%	1,700	<50	200
S.F. Toutle	Primary	M	VH	H	M	H+	+35%	3,600	350	600
N.F. Toutle [C]	Primary	VL	H	H	VL[2]	H	+125%		120	600
Coweeman	Primary	L	VH	VH	L[2]	H	+25%	900	350	500
Kalama	Primary	L	VH	H	L[2]	H+	+45%	800	300	600
N.F. Lewis [C]	Contributing	VL	M	M	VL[2]	M	>500%	8,300	150	400
E.F. Lewis	Primary	M	VH	M	M[1]	H	+25%	900	350	500
Salmon	Stabilizing	VL	H	M	VL[2]	VL	0%	na	<50	--
Washougal	Contributing	L	VH	M	L[2]	M	+15%	800	300	350
Clackamas (OR) [C]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [C]	Primary	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Cascade Summer										
Kalama [C]	Primary	H	VH	M	M[1]	H	0%[4]	1,000	500	500
N.F. Lewis	Stabilizing	VL	VL	VL	VL	VL	0%	na	150	--
E.F. Lewis [G]	Primary	VL	VH	M	VL[2]	H	>500%	600	<50	500
Washougal [C,G]	Primary	M	VH	M	M[1]	H	+40%	2,200	400	500
Gorge Winter										
L. Gorge (WA/OR)	Primary	L	VH	M	L[2]	H	+45%	na	200	300
U. Gorge (WA/OR)	Stabilizing	L	M	M	L[2]	L	0%	na	200	--
Hood (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Summer										
Wind [C]	Primary	VH	VH	H	H[1]	VH	0%[4]	na	1,000	1,000
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

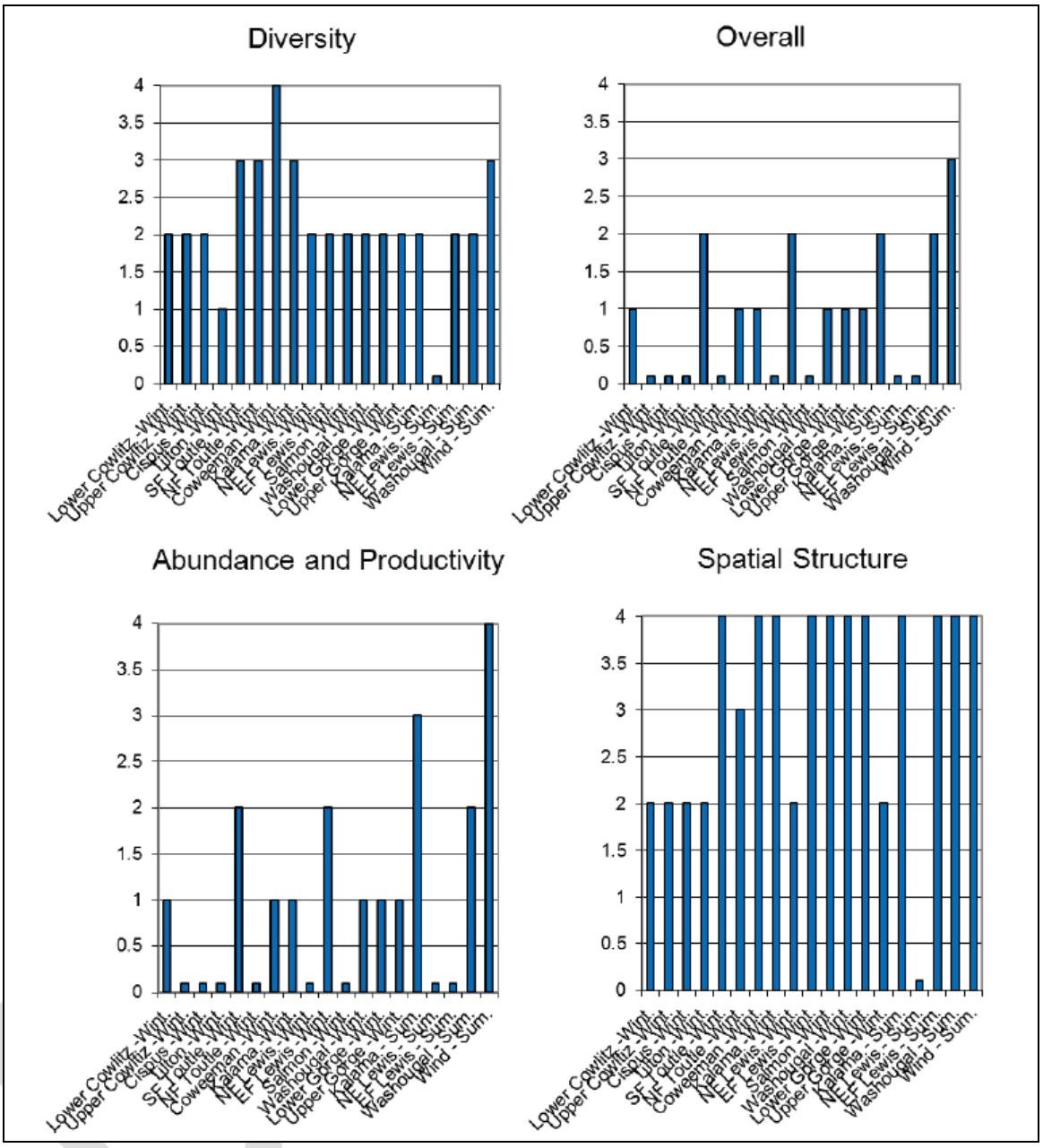


Figure 2.2.2.2: Current status of Washington LCR steelhead populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River coho *(Oncorhynchus kisutch)*: Originally part of a larger Lower Columbia River/Southwest Washington ESU, Lower Columbia coho were identified as a separate ESU and listed as threatened on June 28, 2005. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers. The twenty-one artificial propagation programs include: the Grays River, Peterson Coho Project, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N and Type-S Coho Programs, Lewis River Type-N and Type-S

Coho programs, Fish First Wild Coho and Type-N Coho programs, Syverson Project Type-N Coho Program, and Washougal Hatchery Type-N Coho Program (NMFS 2014 79FR20802)..

Status: Status evaluations of LCR coho status, all based on WLC-TRT criteria, have been conducted since the last BRT status update in 2005 (McElhany et al. 2007, Beamesderfer et al. 2010, LCFRB 2010, Dornbusch and Sihler 2013). All of these evaluations concluded that the ESU is currently at very high risk of extinction. All of the Washington side populations are considered at very high risk, although uncertainty is high because of a lack of adult spawner surveys. The 2005 BRT evaluation noted that smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford 2011). Since this time WDFW has implemented an ESU wide monitoring program for LCR coho which began in 2010. Preliminary results indicate that natural origin population abundance may be higher than previously thought for certain populations (WDFW, unpublished). Results from the first 3 years of monitoring should be available in the near future. Currently, 21 of the 24 Lower Columbia River coho salmon populations are considered to have a very low probability of persisting over the next 100 years, and none is considered viable (Dornbusch and Sihler 2013). All three strata in the ESU fall significantly short of the WLC TRT criteria for viability.

Table 2.2.2.3: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River coho populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [L]	Primary	VL	H	VL	VL[2]	H	+370%	3,800	<50	2,400
Eloch/Skam [L]	Primary	VL	H	VL	VL[2]	H	+170%	6,500	<50	2,400
Mill/Ab/Germ [L]	Contributing	VL	H	L	VL[2]	M	>500%	2,800	<50	1,800
Youngs (OR) [L]	Stabilizing	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [L]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR) [L]	Primary[1]	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR) [L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Cascade										
Lower Cowlitz [L]	Primary	VL	M	M	VL[2]	H	+100%	18,000	500	3,700
Upper Cowlitz [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	18,000	<50	2,000
Cispus [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	8,000	<50	2,000
Tilton [E, L]	Stabilizing[2]	VL	M	L	VL	VL[2]	0%	5,600	<50	--
Toutle SF [E, L]	Primary	VL	H	M	VL[2]	H	+180%	27,000	<50	1,900
Toutle NF [E, L]	Primary	VL	M	L	VL[2]	H	+180%		<50	1,900
Coweeman [L]	Primary	VL	H	M	VL[2]	H	+170%	5,000	<50	1,200
Kalama [L]	Contributing	VL	H	L	VL[2]	L	>500%	800	<50	500
NF Lewis [E, L]	Contributing	VL	L	L	VL[2]	L	+50%	40,000	200	500
EF Lewis [E, L]	Primary	VL	H	M	VL[2]	H	>500%	3,000	<50	2,000
Salmon [L]	Stabilizing	VL	M	VL	VL	VL	0%	na	<50	--
Washougal [L]	Contributing	VL	H	L	VL[2]	M+	>500%	3,000	<50	1,500
Clackamas (OR) [E, L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [E, L]	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L Gorge (WA/OR) [L]	Primary	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge (WA) [L]	Primary[1]	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge/Hood (OR)[E]	Contributing[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[E] Early run (Type S) coho stock.
[L] Late run (Type N) coho stock.
(Core and Legacy populations not designated by the TRT for coho).

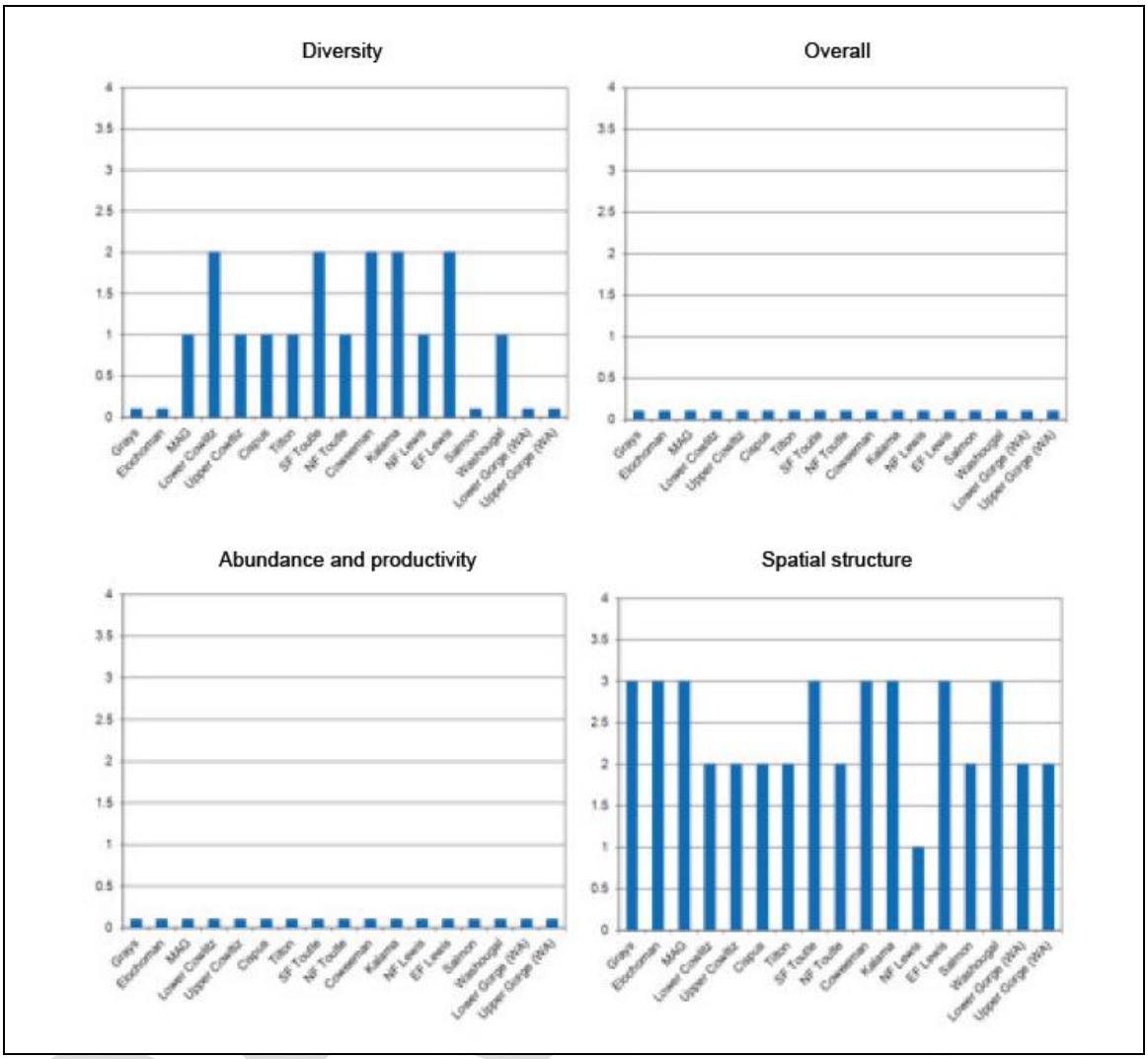


Figure 2.2.2.3: Current status of Washington LCR coho populations for the VSP parameters and overall population risk. (LCFRB 2010 recovery plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Columbia River chum salmon (*Oncorhynchus keta*). ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, as well as artificial propagation programs at Grays River and Washougal River/Duncan Creek chum hatchery programs (NMFS 2014 79FR20802).

Status: A report on the population structure of lower Columbia River salmon and steelhead populations was published by the WLC-TRT in 2006 (Myers et al. 2006). The chum population designations in that report are used in this status update and were used for status evaluations in recent recovery plans by ODFW and LCFRB.

Status: The LCFRB completed a revision recovery plan in 2010 that includes Washington populations of Columbia River chum salmon. This plan includes an assessment of the current status of Columbia River chum populations, which relied and built on the viability criteria developed by the WLC-TRT (McElhany et al. 2006) and an earlier evaluation of Oregon WLC populations (McElhany et al. 2007). This evaluation assessed the status of populations with regard to the VSP parameters of A/P, spatial structure, and diversity (McElhany et al. 2000). The result of this analysis is shown in **Figure 2.2.2.4**. The analysis indicates that all of the

Washington populations with two exceptions are in the overall very high risk category (also described as extirpated or nearly so). The Grays River population was considered to be at moderate risk and the Lower Gorge population to be at low risk. The very high risk status assigned to the majority of Washington populations (and all the Oregon populations) reflects the very low abundance observed in these populations (e.g., <10 fish/year) (Ford 2011). Today, 15 of the 17 populations that historically made up this ESU are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so; this is the case for all six of the Oregon populations. Currently almost all natural production occurs in just two populations: Grays/Chinook and the Lower Gorge. All three strata in the ESU fall significantly short of the WLC TRT criteria for viability (Dornbush and Sihler 2013).

Table 2.2.2.4: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River chum populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [C,G]	Primary	VH	M	H	M[1]	VH	0%[4]	10,000	1,600	1,600
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	>500%	16,000	<200	1,300
Mill/Ab/Germ	Primary	VL	H	L	VL	H	>500%	7,000	<100	1,300
Youngs (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Cascade										
Cowlitz (Fall) [C]	Contributing	VL	H	L	VL	M	>500%	195,000	<300	900
Cowlitz (Summer) [C]	Contributing	VL	L	L	VL	M	>500%	n/a	n/a	900
Kalama	Contributing	VL	H	L	VL	M	>500%	20,000	<100	900
Lewis [C]	Primary	VL	H	L	VL	H	>500%	125,000	<100	1,300
Salmon	Stabilizing	VL	L	L	VL	VL	0%	n/a	<100	--
Washougal	Primary	VL	H	L	VL[2]	H+	>500%	18,000	<100	1,300
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L. Gorge (WA/OR) [C,G]	Primary	VH	H	VH	H[1]	VH	0%[4]	6,000	2,000	2,000
U. Gorge (WA/OR)	Contributing	VL	L	L	VL	M	>500%	11,000	<50	900

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[5] Increase relative to interim Plan.
[6] Reduction relative to interim Plan.
[7] Addressed in Oregon Management Unit plan.
[8] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

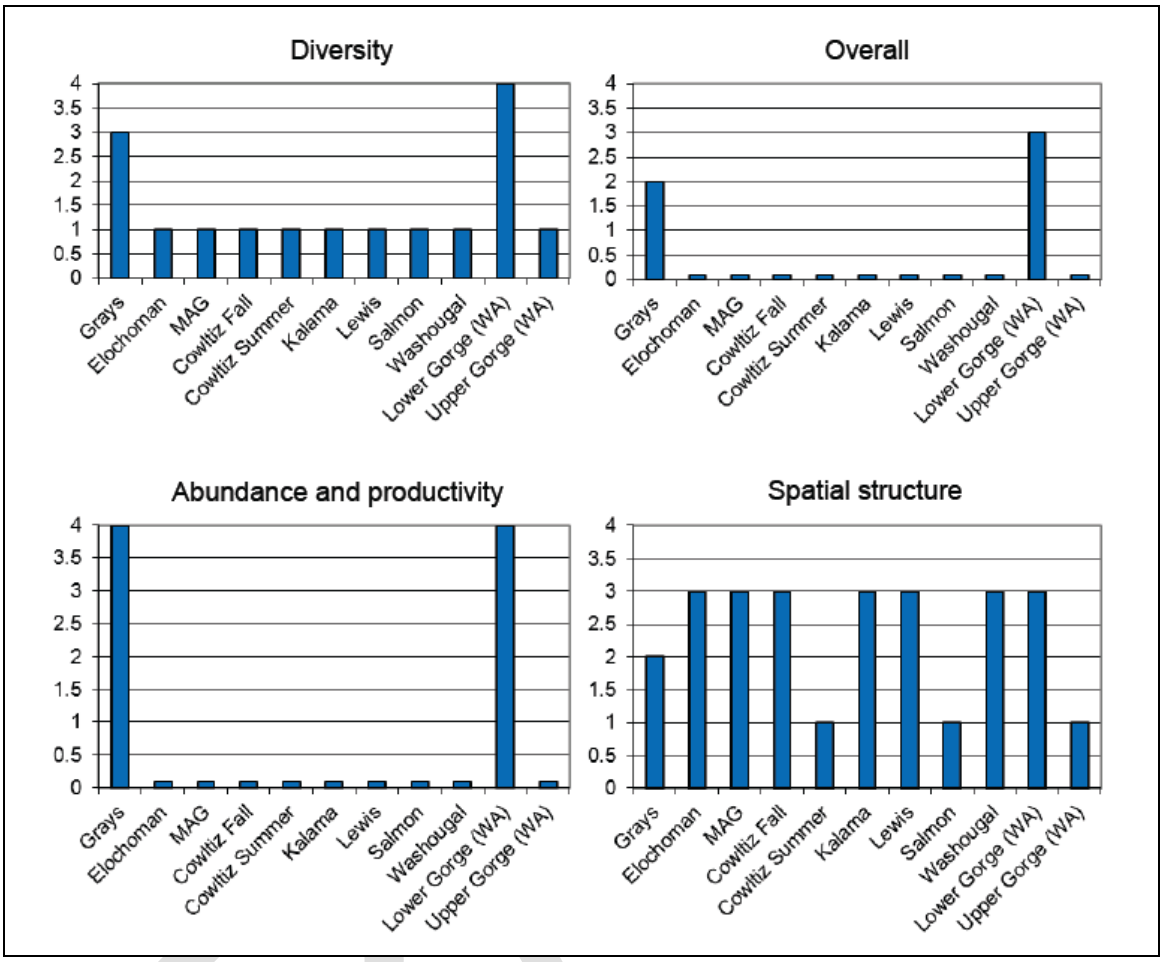


Figure 2.2.2.4: Current status of Washington CR chum populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, Chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population.

Juvenile coho production estimates is the one measure of production in the Lower Columbia system. See HGMP section 11.1 for planned M&E.

Table 2.2.2.5: Lower Columbia River Washington tributary coho smolt production estimates, 1997-2011 (WDFW, Region 5).

Year	Cedar Creek	Mill Creek	Abernathy Creek	Germany Creek	Cowlitz Falls Dam	Mayfield Dam
1997	-----	-----	-----	-----	3,700	700
1998	38,400	-----	-----	-----	110,000	16,700
1999	28,000	-----	-----	-----	15,100	9,700
2000	20,300	-----	-----	-----	106,900	23,500
2001	24,200	6,300	6,500	8,200	334,700	82,200
2002	35,000	8,200	5,400	4,300	166,800	11,900
2003	36,700	10,500	9,600	6,200	403,600	38,900
2004	37,000	5,700	6,400	5,100	396,200	36,100
2005	58,300	11,400	9,000	4,900	766,100	40,900
2006	46,000	6,700	4,400	2,300	370,000	33,600
2007	29,300	7,000	3,300	2,300	277,400	34,200
2008	36,340	90,97	5,077	3,976	-----	38,917
2009	61,140	62,83	3,761	2,576	-----	29,718
2010	-----	-----	-----	-----	-----	49,171
2011	-----	-----	-----	-----	-----	43,831

Source: LCR FMEP Annual Report 2010 and WDFW Data 2012.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 2.2.2.6: Spring Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2012.

Year	Cowlitz	Kalama	Lewis
2000	266	34	523
2001	347	578	754
2002	419	898	498
2003	1,953	790	745
2004	1,877	358	529
2005	405	380	122
2006	783	292	857
2007	74	2,150	264
2008	425	364	40
2009	763	34	80
2010	711	0	160
2011	1,359	26	120
2012	1,359	28	200

Source: Joe Hymer, WDFW Annual Database 2012.

Table 2.2.2.7: Fall Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2011[a].

Year	Elochoman River	Coweeman River[a]	Grays River	Skamokawa Creek	Cowlitz River	Green River (Toutle)	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
2000	884	424	80	482	2,100	1,580	204	3,877	391	6,504	2,757
2001	230	251	104	3	1,979	1,081	102	3,451	245	4,281	1,704
2002	332	566	390	7	3,038	5,654	216	10,560	441	5,518	2,728
2003	2,204	753	149	529	2,968	2,985	327	9,272	607	11,519	2,678
2004	4,796	1,590	745	2,109	4,621	4,188	618	6,680	918	13,987	10,597
2005	6,820	1,090	387	588	10,329	13,846	140	24,782	727	18,913	3,444
2006	7,581	900	82	372	14,427	7,477	450	18,952	1,375	17,106	6,050
2007	194	140	99	36	2,724	961	30	1,521	308	10,934	2,143
2008	782	95	311	253	1,334	824	45	2,617	236	4,268	3,182
2009	231	147	93	139	2,156	1,302	66	4,356	110	6,112	2,995
2010	1,883	1,330	12	268	2,762	605	NE	3,576	314	8,908	4,529
2011	508	2,148	353	41	1,616	668	NE	10,639	334	14,033	2,961

Source: Ron Roler, WDFW Natural Spawn Progress Reports 2012.
* Estimates of total adult and jack fall Chinook. May include fish put upstream of hatchery weirs.

Table 2.2.2.8: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Grays River	Elochoman/ Skamokawa	Mill/Abernathy/ Germany
WDFW Escapement Goal	**1,486**	**853**	**508**
LCSRP Abundance Target	**800**	**600**	**500**
2000	1,064	650	380
2001	1,130	656	458
2002	724	370	354
2003	1,200	668	342
2004	1,132	768	446
2005	396	376	274
2006	718	632	398
2007	724	490	376
2008	764	666	528
2009	568	222	396
2010	422	534	398
2011	318	442	270
3-year average	**436**	**399**	**355**
5-year average	**559**	**471**	**394**
10-year average	**697**	**517**	**378**

Source: WDFW Data 2012.

Table 2.2.2.9: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Coweeman	SF Toutle	NF Toutle/ Green	Kalama	EF Lewis	Washougal
WDFW Escapement Goal	**1,064**	**1,058**	**NA**	**1,000**	**1,243**	**520**
LCSRP Abundance Target	**500**	**600**	**600**	**600**	**500**	**350**
2000	530	490	----	921	NA	NA
2001	384	348	----	1,042	377	216
2002	298	640	----	1,495	292	286
2003	460	1,510	----	1,815	532	764
2004	722	1,212	----	2,400	1,298	1,114
2005	370	520	388	1,856	246	320
2006	372	656	892	1,724	458	524
2007	384	548	565	1,050	448	632
2008	722	412	650	776	548	732
2009	602	498	699	1,044	688	418
2010	528	274	508	961	336	232
2011	408	210	416	622	308	204
3-year average	**513**	**327**	**541**	**876**	**444**	**285**
5-year average	**529**	**388**	**568**	**891**	**466**	**444**
10-year average	**487**	**648**	***588**	**1,374**	**515**	**523**

Source: WDFW Data 2012.
* 7-year average for NF Toutle/Green.

Table 2.2.2.10: Wild summer steelhead population estimates for LCR populations from 2001 to 2011, current WDFW escapement goals, and LCSRP abundance targets.

Location	Kalama	EF Lewis	Washougal	Wind
WDFW Escapement Goal	**1,000**	**NA**	**NA**	**1,557**
LCSRP Abundance Target	**500**	**500**	**500**	**1,000**
2001	286	271	184	457
2002	454	440	404	680
2003	817	910	607	1,096
2004	632	425	NA	861
2005	400	673	608	587
2006	387	560	636	632
2007	361	412	681	737
2008	237	365	755	614
2009	308	800	433	580
2010	370	602	787	788
2011	534	1,084*	956*	1,468
3-year average	**404**	**829**	**725**	**945**
5-year average	**362**	**653**	**722**	**837**
10-year average	**450**	**627**	**652**	**804**

Source: WDFW Data 2012.
* Preliminary estimates.

Table 2.2.2.11: Population estimates of chum salmon in the Columbia River.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010[a]	2011[a]
Crazy Johnson Creek	---	---	966	1,471	3,639	759	1,034	981	677	2,374
WF Grays River	---	---	9,015	1,324	1,232	1,909	800	994	1,967	7,002
Mainstem Grays River	---	---	4,872	1,400	1,244	1,164	886	750	3,467	1,848
I-205 area	3,468	2,844	2,102	1,009	862	544	626	1,132	2,105	4,947
Multnomah area	1,267	1,130	665	211	313	115	28	102	427	641
St Cloud area	---	137	104	92	173	9	1	14	99	509
Horsetail area	---	---	106	40	63	17	33	6	45	183
Ives area[b]	4,466	1,942	363	263	387	145	168	141	214	162
Duncan Creek[c]	13	16	2	7	42	9	2	26	48	85
Hardy Creek	343	392	49	73	104	14	3	39	137	173
Hamilton Creek	1,000	500	222	174	246	79	114	115	247	517
Hamilton Spring Channel	794	363	346	84	236	44	109	91	187	324
Grays return[d]	12,041	16,974	15,157	4,327	6,232	3,966	2,807	2,833	6,399	11,518
I-205 to Bonneville return	11,351	7,324	3,959	1,953	2,426	976	1,084	1,666	3,509	7,541
Lower Columbia River Total	23,392	24,298	19,116	6,280	8,658	4,942	3,891	4,499	9,908	19,059

Source: Todd Hillson - WDFW Chum Program 2012.

[a] Data for 2010 and 2011 is preliminary.

[b] Ives area counts are the carcass tagging estimate plus fish removed for broodstock, except for 2007 and 2008, which is area under the curve.

[c] Totals for Duncan Creek do not include broodstock brought in from mainstem spawning areas, adult trap catch or surveys below monitoring weirs only..

[d] Grays return totals include natural spawners and removed for broodstock.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The proportion of hatchery-origin spawners (pHOS) should be less than 10% of the naturally spawning population for this segregated program, as it is associated with a Contributing natural population, per HSRG guidelines (2009). The currently modelled pHOS value for the program is 0.09. See HGMP section 11.1 for planned M&E.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Describe hatchery activities: The following hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. Broodstock collection activities will directly handle listed fish and will have "take" tables associated with direct broodstock collection or with listed fish lost during handling for release. These tables will occur at the end of this HGMP.

Broodstock Program:
Broodstock Collection: Only identified hatchery fish are retained for spawning. Wild steelhead are returned to stream or transported to the upper basin. The Cowlitz Salmon Hatchery separator adult collection facility enables the program to differentiate all returning adult fish according to hatchery and natural origin fish, since the program fish releases are 100% marked. The ability to differentiate hatchery/natural-origin fish assures the program/stock adheres to the proper segregated broodstocking criteria.

Genetic introgression: Summer steelhead is a non- local stock. The LCFRB and TRT in 2010 did not identify a native summer stock of steelhead in the Cowlitz River (see **Table 2.2.2.2).** The program is run as a segregated program and the purpose of the program is to provide fish for harvest. A high harvest rate of summer steelhead reduces the likelihood that any are spawning with native Cowlitz River steelhead stocks (see **Table 3.3.1.1**. and **Table 3.3.1.2).** The expected gene flow rate can be much lower than the "stray" rate. In a well-run segregated program, the level of gene flow should be quite low for three reasons: 1) the numbers of hatchery-origin fish that have escaped harvest should be low compared to the number of natural-origin fish present; 2) the reproductive success of the hatchery-origin fish can be expected to be low (Leider et al. 1990; Kostow et al. 2003; McLean et al. 2003; McLean et al. 2004); and 3) spawning overlap may be low (Scott and Gill 2008).

Broodstock used for this program are collected at the Cowlitz Salmon Hatchery separator adult collection facility. Summer steelhead begin entering the Cowlitz River system from April and continue through December. The traps are opened for summer steelhead collection during the entire run to allow for collection over the entire run timing. Fish are sorted on a regular schedule as dictated by numbers of fish entering the trap. All fish are identified as natural-or hatchery-origin through examination for fin-clips or CWTs, and are examined for gill net or predator marks. Fish sorted at the collection facility and released may sustain some physical damage but little or no mortality is documented (see "take" tables at the end of this document). Broodstock are spawned at Cowlitz Salmon Hatchery in December and January. Natural-origin native Cowlitz winter stocks interbreeding with Cowlitz Hatchery early summer stock is thought to be low because of differences in spawn timing (LCFRB 2010). Several studies corroborate findings from the earlier work that trans-located domesticated hatchery stocks had poor reproductive success relative to wild fish (Hulett et al. 2004). Crew can quickly distinguish wild steelhead (intact adipose fin) and pass the fish back to the river (see "Take" tables at the end of this HGMP). Indirect take from genetic introgression is currently unknown.

Rearing Program:
Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, effluent, and intake compliance. Effluent at outfall areas is rapidly diluted with mainstem flows and operation is within permitted guidelines (NPDES guidelines).

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the hatchery programs. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1995) Chapter 5 have been instrumental in reducing disease outbreaks. While pathogens occur and may affect fish in the wild, they are believed to go undetected, and are quickly removed through predation. Furthermore, while the Cowlitz Salmon or Cowlitz Trout hatcheries have been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000).

In addition, although pathogens may cause post release mortality in fish from hatcheries, there is little evidence that hatchery origin fish routinely infect natural populations of salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986 and Stewart and Bjornn 1990). Prior to release, the health and condition of the hatchery population is established by the Cowlitz Fish Health Specialist. This is commonly done one to three weeks prior to release, and up

to six weeks on systems with pathogen-free water and little or no history of disease. Indirect take from disease is unknown.

Release:

Hatchery Production/Density-Dependent Effects: Current levels of hatchery production in the Cowlitz River Basin are undergoing ESA consultations between NOAA Fisheries and the WDFW.

Potential Cowlitz hatchery steelhead predation and competition effects on listed salmonids and eulachon: Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). Proposed annual production goal is around 650,000. Actively migrating steelhead smolts releases can begin on April 15, at 5.5 fpp (210 mm fl). Steelhead releases could encounter rearing and emigrating listed Chinook, steelhead and chum in the Cowlitz sub-basin and Columbia mainstem. Due to size differences between steelhead smolts and sub-yearlings, competition is probably low with regards to food and spatial preference between species and size. At 5.5 fpp (210 mm fl), potential predation on listed Chinook would be fish 62-64 mm fl and smaller. Smolts from on station releases in large river systems travel rapidly – migration rates of approximately 20 river miles per day were observed by steelhead smolts in the Cowlitz River (Harza 1999). Once in the lower Columbia River mainstem of tidal influence, Dawley et al (1984) found the average migration rates for sub-yearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 RKm daily respectively.

Table 2.2.3.1: Peak migration timing and average fork length (mm) of out-migrant juvenile Chinook, coho and steelhead captured in rotary screw traps on Mill, Germany and Abernathy creek, Lower Columbia River, 2008.

Stream	Chinook		Coho		Steelhead	
	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration
Mill Cr	37.0	Mar 10-Apr 13	104.2	Mar 17-23	154.5	Apr 28-May 4
Germany Cr	39.8	Mar 17-23	115.3	May 19-25	177.8	May 12-18
Abernathy Cr	37.9	Mar 31 – Apr 6	112.1	May 19-25	163.8	May 12-18

Source: Kinsel et al 2009.

Both juvenile and adult salmonids have been documented to feed on eulachon (Gustafson et al. 2010). Predation of eulachon by steelhead reared in this program may occur, however it is unknown to what degree such predation may occur.

Table 2.2.3.2: Annual smolt collection by species and origin at the Cowlitz Falls Fish Facility from 1997 through 2013.

	Chinook			Steelhead			Coho		Cutthroat	
	Sub-yearling		Unmarked							Total
Season	Hatchery[1]	Unmarked	Yearling	Hatchery	Natural	Unmarked[2]	Unmarked[3]	Unmarked	Unmarked	Smolt
2013		21,760	508			6,757		213,703	380	243,108
2012		23,165	28	0	1	981		10,504	152	34,831
2011	1,234	4,819	4	1	220	5,742		34,632	314	46,966
2010	21,690	10,121	45	7	3,256	9,324		110,378	485	155,306
2009	32,218	2,816	28	8,145	1,586	4,407		40,697	281	90,178
2008	13,870	1,135	10	12,200	837	2,664		14,315	185	45,216
2007	15,778	284	55	19,414	2,401	8,117		104,277	715	151,041
2006	35,997	5,330	54	19,747	1,768	9,585		74,228	738	147,447
2005	11,554	3,222	35	25,345	3,561	17,338		264,921	1,026	327,002
2004	21,195	8,382	20	18,714	5,042	11,276		128,148	718	193,495
2003	26,982	7,741	18	16,463	170	14,740		173,540	1,280	240,934
2002	20,733	5,595	0	591	23,162	5,247		55,029	990	111,347
2001	36,450		25	4,901	33,491	17,807		334,718	1,077	428,469
2000	32,704			89	16,404	17,023	106,880		1,343	174,443
1999	8,878			31	10,783	10,001	15,120		545	45,358
1998	14,917			22	25,921	15,691	109,974		888	167,413
1997	22,815			37	15,621	2,777	3,673		260	45,183
Total	317,015	94,370	830	125,707	144,224	159,477	235,647	1,559,090	11,377	2,647,737

1] 2004-08 numbers based on RV clipped fish captured. 2002 and 2003 based on relative size.

2] Unmarked fish from 2004 onward are assumed to be naturally produced. 2002 and 2003 unmarked numbers based on VIE marking a portion of fry plant. 1997-2001 numbers are a mix of unmarked hatchery fry plants and natural production.

3] Coho smolts from 1997-2000 were a mix of hatchery fry and natural production. Coho smolts from 2001 onward are naturally produced.

Source - Draft Annual Report for the Cowlitz Falls from 1997- 2013.

Residualism: WDFW steelhead programs are reared and released in a smolted condition. To achieve this, the following rearing parameters are followed:

- To maximize smolting characteristics and minimize residual steelhead, WDFW adheres to a combination of acclimation, volitional release strategies, and release guidelines (Tipping 2001).
- Condition factors, including a lean 0.90 to 0.99 K factor, and co-efficient of variation (CVs) of less than 10% are steelhead rearing parameters (see HGMP section 10.3).

Monitoring:

In 2008, WDFW began implementing changes to many of its segregated Lower Columbia River (LCR) steelhead programs as the result of development of the *Conservation and Sustainable Fisheries (C&SF) Plan* (WDFW 2010 draft). Through this plan, WDFW used the All-H Analyzer (AHA) to perform program modeling, combined with the best-available estimates of key model assumptions, to adjust segregated program sizes to meet HSRG standards (see **Attachment #3**). Through this effort, WDFW realized that some assumptions of the AHA model (e.g. harvest rates) needed to be validated and actual gene flow/introgression (or pHOS) needed to be monitored. WDFW has since been reviewing existing monitoring programs for the purpose of identifying improvements that would allow for the validation of key assumptions in the AHA model. WDFW initiated implementation of new monitoring efforts and changes to existing monitoring effort in 2008 for the purpose of collecting data/samples that would address the aforementioned modeling assumption validation needs. Subsequent to implementation improvements to the monitoring program, WDFW began development of a study design to estimate actual gene flow/introgression. The following list provides examples of activities being conducted as part of the improved monitoring program:

- **Summer steelhead monitoring (existing)** – provides information on hatchery/wild proportions during tagging/snorkeling as part of a mark-recapture population abundance estimation methodology.

- **Winter steelhead monitoring (existing)** – redd based surveys to estimate abundance of wild winter steelhead populations in LCR tributaries.
- **Fish In Fish Out (FIFO) monitoring (existing) –** provides information on adult and juvenile production for life cycle monitoring – i.e. productivity.
- **Cowlitz Introgression study (new)** – evaluated introgression rates of early-winter and early-summer hatchery stocks into lower Cowlitz wild winter steelhead population. The Cowlitz River study evaluated the genetic relationship between naturally spawning winter steelhead in the lower Cowlitz River and three hatchery stocks: early-summer-run stock, early winter-run stock and late winter native (Cowlitz River stock). The study found the natural-origin fish were genetically distinct from the hatchery fish; however there was evidence of introgression from the hatchery stocks. The early-winter steelhead program showed the highest level of introgression, and was discontinued. Since completion of the study, WDFW is proposing to move to a SNPs baseline for future studies/monitoring involving genetic introgression instead of the microsatellite baseline used in the Cowlitz analysis. More specifics on the study design have been added to HGMP section 11.
- **Creel Surveys/ Hooking Mortality Study(new) –** implemented on the Wind (hooking mortality), Washougal and SF Toutle (creel surveys) rivers to evaluate harvest, harvest rates (SF Toutle), wild steelhead interception rates and post release mortality rates during fisheries. Long-term vision is a comprehensive program with a rotating design that moves between key watersheds.
- **Genetic sample collection (new and existing)** – genetic samples are collected from adult wild steelhead populations and naturally produced steelhead smolts during summer steelhead monitoring, at winter steelhead trapping locations, during FIFO monitoring (smolts) and potentially during creel surveys. These samples and future sample collections may be valuable in assessing gene flow/introgression (HGMP section 11).

Associated monitoring Activities: In the SA, interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

Gene Flow/Introgression from Hatchery Steelhead Populations to Wild Steelhead Populations: WDFW initiated implementation of new monitoring efforts and changes to existing monitoring effort in 2008 for the purpose of collecting data/samples that would address the In Season Implementation Tool (ISIT) modeling assumption validation needs (see HGMP section 1.16.1). Subsequent to implementation improvements to the monitoring program, WDFW began development of a study design to estimate actual gene flow/introgression. Genetic samples are collected from adult wild steelhead populations and naturally-produced steelhead smolts during summer steelhead monitoring, at winter steelhead trapping locations, during FIFO monitoring (smolts) and potentially during creel surveys. These samples and future sample collections may be valuable in assessing gene flow/introgression (see HGMP section 11).

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Table 2.2.3.3: Mortality of Cowlitz unmarked (natural-origin) adult summer steelhead returning to the Cowlitz Hatchery Complex.

Brood Year	Trap/Holding Mortality
2007	0
2008	0
2009	0

2010	0
2011	0
2012	0
2013	0
Average	**0**

Source: WDFW Hatcheries Headquarters Database 2014.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "Take" tables to be submitted to NMFS. The impacts from harvest are included in the FMEPs.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

No situations are expected to occur where take would exceed ESA limits. If significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist, Fish Health Specialist or Area Habitat Biologist who, along with the Hatchery Complex Manager, would determine an appropriate plan and consult with NOAA-NMFS for adaptive management review and protocols.

Handling and release of wild steelhead in broodstock trapping operations is monitored and take observations have been rare. Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

WDFW has several policies/plans that help inform management decisions regarding the HGMPs currently under review. These policies include:

1. Hatchery and Fishery Reform Policy (Commission Policy C3619)
2. The Statewide Steelhead Management Plan (SSMP)
3. The Conservation and Sustainable Fisheries Plan (draft)
4. The Hatchery Action Implementation Plans (HAIP)
5. Lower Columbia Salmon Recovery Plan (LCSRP)

Descriptions of these policies and excerpts are shown below:

Policies/Plans – Key Excerpts

Hatchery and Fishery Reform Policy

Guidelines from the policy include:

1. Use the principles, standards, and recommendations of the Hatchery Scientific Review Group (HSRG) to guide the management of hatcheries operated by the Department.
2. Develop watershed-specific action plans that systematically implement hatchery reform as part of a comprehensive, integrated (All-H) strategy for meeting conservation and

harvest goals at the watershed and Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) levels. Action Plans will include development of stock (watershed) specific population designations and application of HSRG broodstock management standards.

Statewide Steelhead Management Plan. In February 2008, WDFW formally adopted a *Statewide Steelhead Management Plan* (SSMP) that guides statewide policies, strategies and actions pertaining to steelhead in Washington State. This plan calls for the development of regional watershed plans that further guide steelhead management at the local level. WDFW is currently developing regional watershed plans for all LCR steelhead populations. This process includes the development of stakeholder workgroups that provide input into the planning process. During this process, all current hatchery steelhead programs are being reviewed and evaluated for possible program improvements. Program improvements could include, but are not limited to, changes in smolt release numbers, changes in broodstock composition (e.g. converting to indigenous stock), and changes in fishery regulations to better protect adults and/or juveniles. Additionally, the SSMP calls for the development of a network of wild steelhead gene banks throughout the state and these gene banks will be implemented through the regional watershed steelhead management plan development process.

"The Department will use the SSMP to build on the habitat work already done by the watershed and regional groups by incorporating hatchery, harvest and hydro actions into watershed plans. These watershed plans will then be combined into Regional Management Plans for each Distinct Population Segment (DPS)."

- In Southwest Washington (Region 5), WDFW will develop watershed work groups to assist in the development of the regional watershed plans. Work group status is:
  - Coweeman, Toutle, Kalama – completed in 2012/2013
  - Upper & Lower Gorge – completed in 2013
  - Lewis, Salmon, Washougal – completed in 2014
  - Grays, Elochoman/Skamokawa, Mill/Abernathy/Germany – proposed to start in 2014/2015
  - Upper & Lower Cowlitz – plans will be developed consistent with the updated Fisheries and Hatchery Management Plan (FHMP update 2011), developed by the Cowlitz Fisheries Technical Committee (FTC) with input from the Cowlitz Ad-Hoc Advisory Group.

Several strategies and actions included in the SSMP are shown below:

- *Establish Network of Wild Stock Gene Banks*. The gene bank must be a place where wild stocks are largely protected from the effects of hatchery programs. At least one wild stock gene bank will be established for each major population group in each steelhead DPS.
- *Describe Path with Measurable Benchmarks to Long-term Goals*. Evaluate the current benefits and risks of the current program relative to the long-term goals for each stock. Describe a path to the long-term goals with measurable benchmarks for modifications to fishery, hatchery, and habitat management and the expected performance of each stock. For programs affecting the wild stocks of importance for conservation and recovery, the long-term goal will include the following elements:
  - Segregated programs implemented to enhance harvest opportunities (i.e. segregated harvest program) will result in an average gene flow of less than 2% from the hatchery to the wild stock. Use broodstock that originated from releases of juveniles in that watershed unless no hatchery or trapping facility exists.
  - Segregated conservation programs implemented to maintain the hatchery population as a distinct or genetically segregated population in order to preserve and recover depleted wild stocks.

- Assess the current risks and benefits, including economic benefits, of each artificial production program relative to genetic, demographic, and ecological risk factors. Key factors to include in the risk assessment for each type or program are discussed below.
  - Segregated Programs. Key risks associated with segregated programs are a potential loss of diversity (within and between stocks), loss of fitness, and competition.
    - Evaluate the potential range of gene flow from returning adults of hatchery-origin to wild-origin stocks in all watersheds where early-winter or early-summer steelhead stocks are released, or where a segregated program has been in place for three or more generations.
  - Where risks are inconsistent with watershed goals, implement one or more of the following actions:
    - Leave trapping facilities open during the entire return time for adults of the segregated stock.
    - Eliminate recycling of hatchery-origin adults to anadromous waters.
    - Release steelhead juveniles from steelhead programs only at locations where returning adults can be captured.
    - Increase the harvest rates on hatchery-origin fish.
    - Reduce the number of fish released or change the release location, rearing practices affecting the rate of residualism, or other program characteristics to reduce the rate of gene flow.
    - Eliminate the segregated hatchery program.
    - Replace the segregated program with an integrated program with risks that are consistent with watershed goals.

Conservation and Sustainable Fisheries Plan (CSFP): The CSFP is a draft plan that has been developed to meet WDFW's responsibilities outlined in the Lower Columbia Salmon Recovery Plan (LCSRP) and address the HSRG suggested solutions and achieve HRSG standards for primary, contributing and stabilizing populations. The plan describes the implementation of changes to hatchery and harvest programs and how they assist in recovery and achieve HSRG guidelines. The draft plan also identifies Viable Salmonid Population (VSP) parameters that will be addressed.

Hatchery Action Implementation Plans (HAIP): The HAIPs illustrate how WDFW is implementing hatchery programs to incorporate the HSRG guidelines. The plans provide the current programs and explain the future goals.

Lower Columbia Salmon Recovery Plan (LCSRP): Some sub-basins will be free of hatchery influence and hatchery programs. In other sub-basins, hatchery programs will serve specific conservation and harvest purposes consistent with goals for naturally-spawning populations. The mosaic of programs is designed to ensure that overall each DPS will be naturally self-sustaining.

Strategies

1. Reconfigure production-based hatchery programs to minimize impacts on natural populations and complement recovery objectives.
2. Adaptively manage hatcheries to respond to future knowledge, enhance natural production, and improve operational efficiencies.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Future Brood Document. Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document, a pre-season planning document for fish hatchery production in

Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30).

Cowlitz Basin Fish Management Plan. The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River Basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.

Cowlitz Hatchery Mitigation Agreement (*FERC Project #2016*). After the original license expired on December 31, 2001, the Project has operated under annual licenses until the new thirty-five year license was issued March 13, 2003 (effective on July 18, 2003). The new license requires formation of the Cowlitz Fisheries Technical Committee (FTC), which includes NMFS, USFWS, WDFW, WDOE, American Rivers/Trout Unlimited, the Yakama Nation, and Tacoma Power. The FERC license was amended July 2004, based on NOAA's Biological Opinion that required Tacoma Power to achieve a fish passage survival goal of 75-95% (with best available technology). Tacoma Power has published an annual progress report since 2005.

Cowlitz Fisheries and Hatchery and Management Plan (*FHMP update 2011*). The FHMP is part of the new Settlement Agreement (Article 6), that identifies the quantity and size of fish produced at the hatcheries, the rearing and release strategies for each stock, plans for funding on-going monitoring and evaluation, and management strategies consistent with the objective of maximizing natural-origin fish production. The plan requires updates every six-years.

Cowlitz Falls Project- Lewis County Public Utility District (*PUD*) (*FERC No. 2833*). The Lewis County PUD No. 1 constructed a hydroelectric project on the Cowlitz River, which was completed in 1994. BPA constructed and oversees the operation of a downstream fish collection facility at the dam. NOAA issued a Biological Opinion dated June 2, 2009.

See also HGMP section 3.1.

3.3 Relationship to harvest objectives.

3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available. *Hatchery Escapement (FHMP)*

Early summer steelhead are harvested in a variety of sport fisheries in Washington. Steelhead are occasionally harvested in marine fisheries, but the number of Cowlitz River fish taken is inconsequential. Fisheries directed at the harvest of Cowlitz River early summer steelhead operate in the lower Columbia River and in the Cowlitz River downstream of the Barrier Dam. Sport fisheries occur in the lower Columbia and Cowlitz year round and total adult equivalent exploitation rates have been estimated at 70%. Ocean and freshwater net harvest (Lower Columbia) is non-directed and insignificant.

See also **HGMP section 1.12**.

Incidental impact on non-targeted wild steelhead. Selective fisheries rules were initiated for steelhead in lower Columbia River tributaries in 1986 (1990s in Puget Sound) to provide maximum sport harvest (retention of adipose-clipped fish only) and requires the release of all wild steelhead. This has reduced wild steelhead harvest statewide to approximately 1% of the catch. Selective gear restrictions and cool water temperatures minimize mortality on listed steelhead. Non-targeted wild steelhead may be hooked and released with an unknown impact for most streams and direct studies have not been done in this system. Nelson et al. (2005) showed catch and release mortalities of 1.4% to 5.8% in 1999 and 2000 respectively on steelhead caught in recreational fisheries on the Chilliwack River in British Columbia. This study also showed no indication of increased mortality on fish that had been caught released multiple times. As such

hooking mortality associated with recreational sport harvest is generally believed to be less than 10% of fish hooked and released.

Table 3.3.1.1: Cowlitz River summer (early-stock) steelhead harvest, based on WDFW Catch Record Card (CRC) data for BYs 2000-2007 (release years 2001-2006, fishery years 2003-2010).

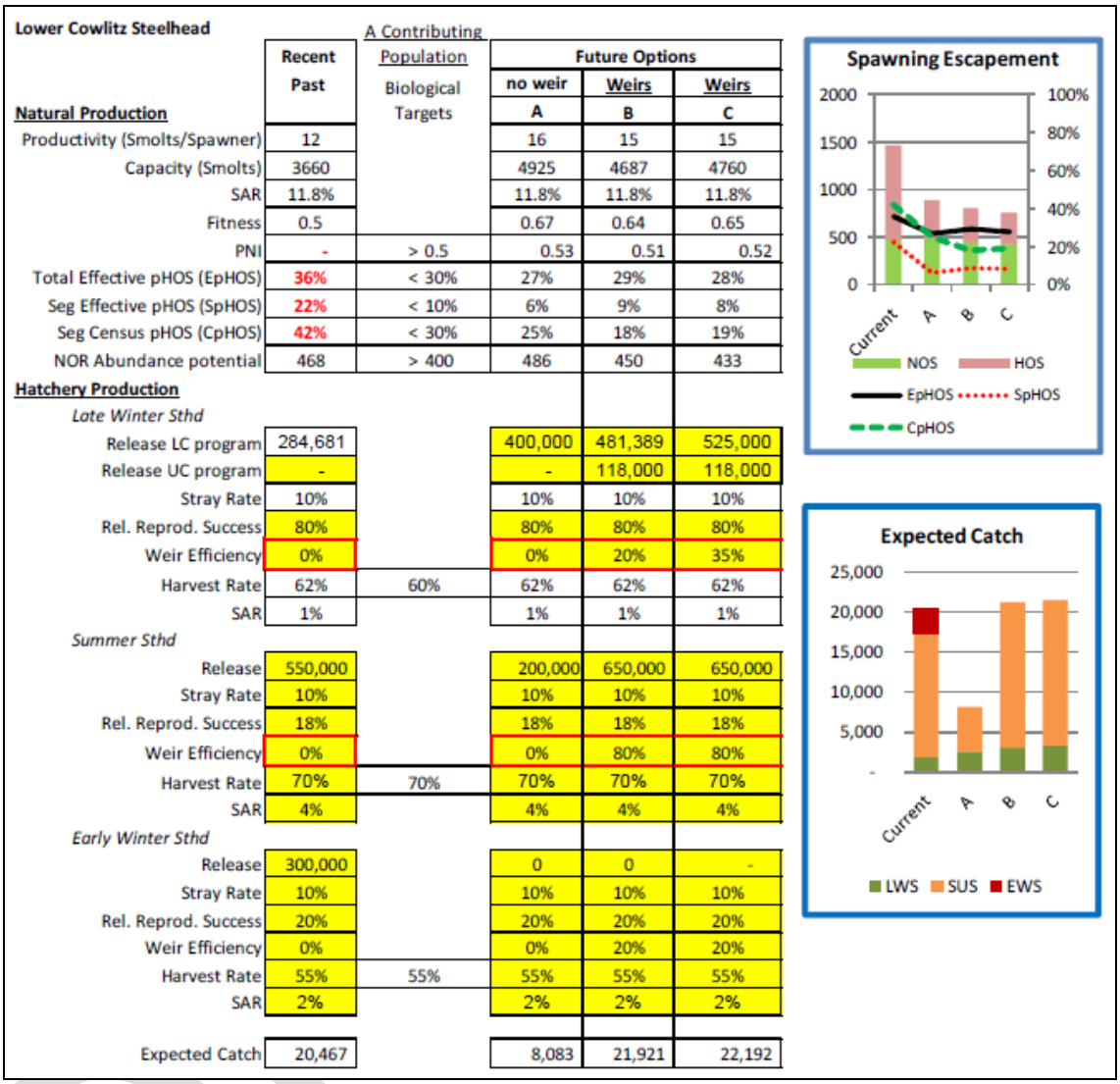
Return Year	Total Released	Sport Harvest	Hatchery Escapement	SAR %
2003	741,132	17,444	10,940	3.83
2004	614,227	30,921	6,109	6.03
2005	230,973	7,111	13,161	8.78
2006	477,224	19,669	4,972	5.16
2007	202,860	6,537	10,521	8.41
2008	526,231	11,878	2,747	2.78
2009	502,754	7,284	8,492	3.14
2010	547,105	8,874	6,202	2.76
Total	**3,842,506**	**109,718**	**63,144**	
Average	**480,313**	**13,715**	**7,893**	**4.50**

Source: WDFW catch record cards (CRC), WDFW Hatcheries Headquarters Database 2012.
Notes: -Harvest based on Cowlitz River catch only, does not include mainstem Columbia.
-Includes Friends of Cowlitz summer steelhead plants; FOC plants were discontinued in 2012.
-Escapement numbers in 2003 and 2004 are underestimated, and thus SAR is probably too low.
-Sport harvest based on total harvest and the proportion of fish released for this program out of the total for the system.

Table 3.3.1.2: Angler trips and catch of early-summer steelhead, May-June, Lower Columbia River mainstem 2000-2012.

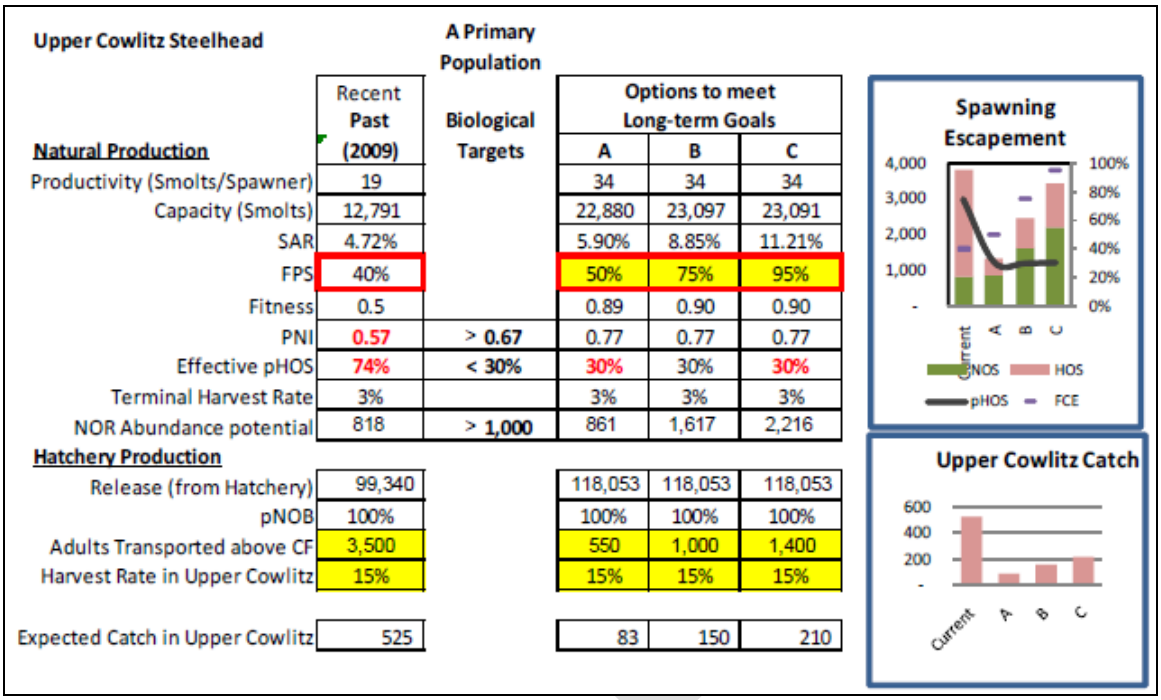
Year	Angler Trips	Catch		
		Total	May	June
2000	16,525	1,619	533	1,086
2001	18,485	1,966	501	1,465
2002	50,955	4,404	1,383	3,021
2003	47,765	2,691	1,076	1,615
2004	25,866	2,954	879	2,075
2005	27,398	2,055	407	1,648
2006	42,285	3,021	741	2,280
2007	39,498	2,695	799	1,896
2008	30,505	2,035	CLOSED	2,035
2009	27,678	1,381	CLOSED	1,381
2010	40,133	4,220	819	3,401
2011	70,422	4,371	1,076	3,295
2012	54,072	4,049	912	3,137

Source: J. Watts, ODFW 2012.



Lower Cowlitz Steelhead	Recent Past	A Contributing Population Biological Targets	Future Options: no weir A	Weirs B	Weirs C
Natural Production					
Productivity (Smolts/Spawner)	12		16	15	15
Capacity (Smolts)	3660		4925	4687	4760
SAR	11.8%		11.8%	11.8%	11.8%
Fitness	0.5		0.67	0.64	0.65
PNI	-	> 0.5	0.53	0.51	0.52
Total Effective pHOS (EpHOS)	36%	< 30%	27%	29%	28%
Seg Effective pHOS (SpHOS)	22%	< 10%	6%	9%	8%
Seg Census pHOS (CpHOS)	42%	< 30%	25%	18%	19%
NOR Abundance potential	468	> 400	486	450	433
Hatchery Production					
Late Winter Sthd					
Release LC program	284,681		400,000	481,389	525,000
Release UC program	-		-	118,000	118,000
Stray Rate	10%		10%	10%	10%
Rel. Reprod. Success	80%		80%	80%	80%
Weir Efficiency	0%		0%	20%	35%
Harvest Rate	62%	60%	62%	62%	62%
SAR	1%		1%	1%	1%
Summer Sthd					
Release	550,000		200,000	650,000	650,000
Stray Rate	10%		10%	10%	10%
Rel. Reprod. Success	18%		18%	18%	18%
Weir Efficiency	0%		0%	80%	80%
Harvest Rate	70%	70%	70%	70%	70%
SAR	4%		4%	4%	4%
Early Winter Sthd					
Release	300,000		0	0	-
Stray Rate	10%		10%	10%	10%
Rel. Reprod. Success	20%		20%	20%	20%
Weir Efficiency	0%		0%	20%	20%
Harvest Rate	55%	55%	55%	55%	55%
SAR	2%		2%	2%	2%
Expected Catch	20,467		8,083	21,921	22,192

Figure 3.3.1.1: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest and conservation goals for Lower Cowlitz steelhead (Source: FHMP update 2011).



Upper Cowlitz Steelhead	Recent Past (2009)	A Primary Population Biological Targets	Options to meet Long-term Goals A	B	C
Natural Production					
Productivity (Smolts/Spawner)	19		34	34	34
Capacity (Smolts)	12,791		22,880	23,097	23,091
SAR	4.72%		5.90%	8.85%	11.21%
FPS	40%		50%	75%	95%
Fitness	0.5		0.89	0.90	0.90
PNI	0.57	> 0.67	0.77	0.77	0.77
Effective pHOS	74%	< 30%	30%	30%	30%
Terminal Harvest Rate	3%		3%	3%	3%
NOR Abundance potential	818	> 1,000	861	1,617	2,216
Hatchery Production					
Release (from Hatchery)	99,340		118,053	118,053	118,053
pNOB	100%		100%	100%	100%
Adults Transported above CF	3,500		550	1,000	1,400
Harvest Rate in Upper Cowlitz	15%		15%	15%	15%
Expected Catch in Upper Cowlitz	525		83	150	210

Figure 3.3.1.2: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest goals for Upper Cowlitz steelhead (Source: FHMP update 2011).

3.4 Relationship to habitat protection and recovery strategies.

The re-licensing impact associated with Tacoma Power and Lewis County PUD continued operation of hydroelectric facilities including the dams creating Mayfield Lake, Riffe Lake and Lake Scanewa are major factors that affected natural production of resident and anadromous fish species. Project impacts are to fish and wildlife but the following pertains to fish only and include:

1) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related barriers, false attraction, entrainment in intakes, and other impediments to fish migration;
2) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related mitigation hatchery fish interactions with remaining wild fish;
3) impacts to resident and anadromous fishes in reservoirs from fluctuations in reservoir level;
4) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow-dependent habitat changes;
5) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow fluctuations;
6) impacts to resident and anadromous fishes in the reservoir and downstream caused by project-related channel changes stemming from alteration of natural sediment transport;
7) changes in dynamics of fish-predator interactions resulting from change in fish escape options;
8) changes in water quality (e.g., temperature, dissolved gases, suspended sediment, pollutants) which can impact fish (and wildlife);
9) interruption of the transport of large wood and nutrients from upstream to downstream reaches and nutrient transport upstream in the form of adult anadromous fish;
10) inundation of anadromous fish spawning, incubation, and rearing habitat by Mayfield, Mossyrock and Cowlitz Falls dams, resulting in loss of anadromous fish production from the inundated reaches.

Several FERC Settlement Agreement articles address passage problems in the system including: 1) Downstream Fish Passage for Riffe Lake and Cowlitz Falls; 2) Downstream passage for Mayfield

Lake; and 3) Upstream Fish Passage for the barrier dam, Mossyrock and Mayfield. The articles also deal with future proposals and improvement needed for restoring processes upstream and down. Additionally a fish habitat fund of up to 3.0-million dollars for identified projects has been created (Article 11).

Additional Processes:
The following processes have included habitat identification problems, priority fixes and evolved as key components to the *Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans* (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, LCFRB 2010) and Lower Columbia River Salmon and Steelhead ESA Recovery Plan (Dornbusch and Sihler 2013)).

Sub-Basin Planning. Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Subbasin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan.

The Lower Columbia fish Recovery Board (LCFRB) has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004, revised June 6, 2010) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection - Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in the *Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans*, and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's Habitat Program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA). A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven sub-basins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

3.5 Ecological interactions

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* Out-migrant hatchery fish can be preyed upon through the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays, as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons in the Columbia mainstem sloughs, can prey on steelhead smolts. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted through a complex web of short and long term processes and over

multiple time periods which makes evaluation of this a net effect difficult. Recent WDFW research (Sharpe et al 2008) has shown that the predation risk from hatchery steelhead smolt releases on smaller fish are minimal. See also HGMP section 2.2.3 "*Predation and Competition*."

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Only hatchery steelhead are released, but natural production of steelhead, Chinook, coho and chum salmon occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.). The presence of other natural-origin salmonids in the food web potentially reduces the impacts associated with predation described in "(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program"* above.

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* Nutrients provided by decaying carcasses might benefit fish and aquatic invertebrates in freshwater (Wipfli et al. 1998; Mathisen et al. 1988; Bilby et al. 1996). The program could also positively impact freshwater and marine species that prey on juvenile fish. These species include:

- Northern pikeminnow
- Chinook salmon, steelhead, coastal cutthroat trout
- Pacific staghorn sculpin
- Eulachon
- Numerous marine pelagic fish species
- Avian predators, including: gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons
- Mammals including: harbor seals, sea lions, river otters and orcas.

4 SECTION 4. WATER SOURCE

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Table 4.1.1: Water sources at Cowlitz Trout and Cowlitz Salmon Hatcheries.

Facility	Water Source	Water Right		Available Water Flow	Avg Water Temp (ºC)	Usage	Limitations
		Record/Cert. No.	Permit No.				
Cowlitz Trout Hatchery	Wells (9)	G2-*08490C WRIS (north)/ 06331	07887	4,861 gpm	8-12°	Initial rearing. Also used to regulate water temperature in the facility.	Water from the north well has some bacteria and gas problems
		G2-*08491C WRIS (south)/ 06364	07888	860 gpm			
	Ozone Plant (Cowlitz River surface)	S2-*19839C/ 10453	14603	20 cfs	n/a	Used from May to late-November/ early-December to avoid river pathogens (primarily *Ceratomyxa shasta*).	Cannot supply the volume of water needed from early-December to mid-May
	Cowlitz River (surface)			56 cfs	4-15	Primary supply and backup water source in case of well water system failure.	Not treated with ozone.
Cowlitz Salmon	Well	G2-*08829CWRIS/ 06699	08197	2,060 gpm	6-9	Incubation/early rearing	None
	Well	G2-*8830CWRIS/ 06700	08198	2,860 gpm			
	Cowlitz River (surface)	S2-*19889CWRIS/ 10450	14724	200 cfs	4-13	Hatchery supply	BKD, IHNV, *C. shasta*

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW hatchery data.

Cowlitz Salmon Hatchery: The Cowlitz Salmon Hatchery is supplied from three sources. The majority of water is supplied from the Cowlitz River, with a maximum of 75,000 gallons per

minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other two sources are "C-wells" (1,000 gpm) and "PW–wells"(700 gpm). The wells are used between August and April, normally for egg incubation and early fry rearing. The temperature of water supplied to the Cowlitz Salmon Hatchery ranged from 4° to 13°C for river water, and from about 6° to 9°C for the groundwater (Harza 1997a in FERC 2001). An additional water right of 8 cfs was obtained for the BPA funded Stress Relief Ponds (SRP) for utilization with the upper Cowlitz River Restoration Project. Stress relief ponds have an alarm at the head box.

The water right permit for the Cowlitz Salmon Hatchery formalized through the Washington Department of Ecology (see **Table 4.1.1**), and was obtained by Tacoma Power in 1966 (surface) and 1967 (wells).

These facilities operate under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permits which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE).

Cowlitz Trout Hatchery: The facility has three water sources. The majority of the water is supplied from nine shallow wells on both sides of the river, at up to 5 cubic feet per second (cfs), with a water temperature of 10°C (Harza 1997a in FERC 2001). The wells are used for the potential incubation and initial rearing of fry. The north well is inundated with iron bacteria and has not been utilized since fall 2000. Tacoma Power installed an auxiliary power generator to the south wells.

An ozone plant is used to disinfect up to 20 cfs of water from the Cowlitz River. The ozonated water is used from May to late-November/early-December to avoid river pathogens (primarily *Ceratomyxa shasta*); the plant cannot supply the volume of water needed from early-December to mid-May. The plant is capable of producing 200 pounds of ozone daily, and is equipped with an auxiliary electrical generator. The river intake is able to supply 56 cfs of river water, or 20 cfs while the ozone plant is operating. Water temperature ranges from 4° to 16°C, and only rarely exceeds 15°C.

The water right permit for the Cowlitz Trout Hatchery formalized through the Washington Department of Ecology, and was obtained by Tacoma Power (**Table 4.1.1**) in 1966 (surface) and 1967 (wells).

This facility operates under the *"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination Syste*m (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (WDOE) (see **Table 4.1.1**).

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids (TSS)* 1 to 2 times per month on composite effluent, maximum effluent and influent samples.
- *Settleable Solids (SS)* 1 to 2 times per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Table 4.2.1: Record of NPDES permit compliance at Cowlitz Salmon and Cowlitz Trout Hatcheries.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
Cowlitz Salmon Hatchery WAG13-1021	Y	Y	Y	3/6/2013	0	N	Y
Cowlitz Trout Hatchery WAG13-1034	Y	Y	Y	3/20/2013	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2014.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The surface water intakes at both facilities are in compliance with state and federal guidelines (NMFS 1995, 1996), but does not meet current *Anadromous Salmonid Passage Facility Design* criteria (NMFS 2011a). This assessment is based on structural components and the hydraulics of the intake by WDFW (November 16, 2004 Intake Assessment, Cowlitz Salmon hatchery, Ray Berg, Lead Project Engineer). Velocity through intake screens, sweep velocity, mesh openings and juvenile bypass from screens do not meet criteria.

During the facilities renovation (completed in 2010), major modification of the intake at Cowlitz Salmon Hatchery was not made by Tacoma Power because of the uncertainty over the potential breaching of the Barrier Dam. The water diversion and pump intakes at the salmon hatchery do not have adequate screens and may also pose a potential risk to naturally produced Chinook. Currently, the diversion and water intake structure for the Cowlitz Salmon Hatchery is adjacent to and immediately upstream of the Barrier Dam, and is not completely screened. There is some potential risk that some naturally produced fall Chinook juveniles could be taken should they enter this structure. Tacoma Power is investigating the intake to see if reasonable measures could result in improvements.

Water discharged from the CTH into Blue Creek (WRIA 26.0527, tributary to the Cowlitz at RKm 66.5) is a little warmer than the Cowlitz River during spring and summer. The dissolved oxygen levels of the effluent are typically 1-2 mg/L lower than the Cowlitz River (Harza 2000 in FERC 2001). Re-used well water from incubation units is redirected to early-rearing units. Currently all incubation takes place at Cowlitz Salmon Hatchery.

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

Cowlitz Salmon Hatchery (*CSH*): The adult collection facility at the Cowlitz Salmon Hatchery consists of a 318-ft long Barrier Dam across the Cowlitz River. The Barrier Dam directs upstream-migrant fish to the fish ladder, which leads to the sorting and transfer facilities. There are right and left bank entrances to the fish ladder and an under spillway transport channel connecting the two ladder entrances. Fish move up the ladder to the sorting, transfer and holding facilities. Since construction in 1969, neither the transport channel nor the left bank entrance are in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds including nine concrete ponds (80’ x 15’ x 6’) via transfer tubes.

Cowlitz Trout Hatchery (*CTH*): The facility has an adult trapping and holding facility that includes a weir and fish ladder in Blue Creek. The weir was removed in 2008. The adult holding facility consists of three adult ponds @ 10'x150'x5'. Fish are hand sorted and handled according to the *Cowlitz Complex Adult Fish Handling Protocol*. Fish are returned from this facility to the river by truck. Adult trapping at CTH was discontinued in 2007 with the exception of anadromous coastal cutthroat that are collected at either of the two hatchery outfalls and transported to Cowlitz Salmon Hatchery.

5.2 Fish transportation equipment (description of pen, tank truck, or container used).

CSH: The facility has three 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through water displacement. This process results in low stress to the adult fish. All vehicles have juvenile and adult holding capability. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

In addition, several smaller tankers with air stones (one 750-gallon, one 1,000-gallon fiberglass tank, and several 250-gallon tanks) are utilized for moving fish around and between the facilities. All vehicles have juvenile and adult holding capability, and are equipped with oxygen and recirculating systems.

CTH: The facility has one 1,500 gallon fish tanker, which can be used to transfer juvenile fish between facilities. The vehicle has juvenile and adult holding capability, and is equipped with oxygen and recirculating systems. The tanker also has a hydraulic loading boom for loading adults from the CTH adult ponds

5.3 Broodstock holding and spawning facilities.

Table 5.3.1: Adult holding/spawning facilities available at Cowlitz Salmon Hatchery.

Ponds (number)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	-	13.5	5.25	800
9	Concrete Ponds	7,200	80	15	6.0	2,700

CSH. Adults are separated to the ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

Table 5.3.2: Adult holding/spawning facilities available at Cowlitz Trout Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
3	Adult holding ponds	7,500	150	10	5	1,500

CTH. The facility has three 10' X 150' X 5' adult holding ponds. Adult trapping at CTH was discontinued in 2007 with the exception of anadromous coastal cutthroat that are collected at either of the two hatchery outfalls and transported to Cowlitz Salmon Hatchery.

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available at Cowlitz Salmon Hatchery.

Type	Units (number)	Flow (gpm)	Volume (cu. ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Vertical stack units (16 trays/ Stack Unit)	160 (2,560 trays)	12 gpm on 4 units-		7,000	7,000
Free style deep isolation incubators	8 units	24 gpm all units		250,000 - 300,000[a]	
Vertical stack units (16 trays/Stack Unit) Recirculation Systems A&B	36 Stacks (288 trays)	3-5	-	10,000[b]	10,000[b]

[a] Green egg stage only
[b] Steelhead and cutthroat

CSH. The facility incubates steelhead on Recirculation Systems A&B on ground water via once thru mode (fresh supply), or on recirculation mode (reclaimed supply with added fresh or makeup supply).

Table 5.4.2: Incubation vessels available at Cowlitz Trout Hatchery.

Type	Units (number)	Flow (gpm)	Volume (cu. ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Shallow troughs (2-tier) with incubation baskets	88	3.5-5.0	7.165/ trough	20,000 (5 baskets/trough)	21,000 (1 basket/trough)

CTH. The facility has 88 shallow trough incubators. Currently all incubation for the program takes place at CSH.

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Cowlitz Salmon Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
36	California Style Raceways	11,000	200	10	5.5	2,500	1.61	0.3
1	Concrete Backwash Kettle	8,000	200	5	8.0	50		
12	BPA Concrete Raceway	1,260	45	8	3.5	250	1.61	0.3

CSH The facility early rears steelhead in troughs on Recirculation Systems A&B on ground water via once thru mode (fresh supply) or on recirculation mode (reclaimed supply with added fresh or makeup supply). The facility has 36 modified Burrows ponds. The 12 BPA Stress Relief Ponds and two starter vessels were added to this facility in 1996 to assist the Upper Cowlitz River Reintroduction Program.

Table 5.5.2: Rearing ponds available at Cowlitz Trout Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
88	Shallow troughs	7.165	14.33	1.0	0.5	7-10		
2	Intermediate troughs	40.4	13.5	2.3	1.3	30	1.0	0.25
2	Magnum troughs	145.2	11	4.4	3	60	1.0	0.25
6	Fry raceways	2,000	80	10	2.5	300	1.0	0.25
24	Concrete raceways	5,340	100	20	2.67	1,000	1.0	0.25
3	5.0 acre lake	1,856,000	1,450	160	8.0	4,000	N/A	N/A
1	2.5-acre Lake	1,113,600	870	160	8.0	4,000	N/A	N/A

CTH. The facility has six fry raceways each 10' x 80' x 2.5', 24 raceways each 20' x 100' x 2.7', three 5-acre lakes, one 2.5 acre lake and three adult holding ponds each 10' x 150' x 5'.

5.6 Acclimation/release facilities.

CTH. The raceways at the CTH have no outlet to the river, so program fish must be trucked out of these ponds for release. Water discharged from the raceways can be routed to the adult ponds, the rearing lakes or the pollution abatement ponds, but not directly to the river. The rearing lakes are used for final rearing of yearlings to smolts and directly discharge to the Cowlitz River via Blue Creek.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

CSH. Recirculation Systems A&B with the incubation and early rearing of steelhead stocks have experienced epizootic outbreaks of the bacterial infections; Bacterial Cold Water Disease (BCWD) and Bacterial Gill Disease (BGD). The UV disinfection process has been the concern in recirculation mode but infections have occurred on ground water via once through mode.

CTH. Generally, no physical operational difficulties have been experienced. Pathogen outbreaks of BCWD, *Ceratomyxa shasta* and IHNV have chronically caused some significant fish mortality in the past. Installation of an ozone treatment facility in 1991 has decreased mortality significantly.

Avian predation in the raceways was the major cause of the numerous shortages on all stocks in 2003. Bird boards were installed on all raceways to deter herons from feeding off the screens. Electric fencing was reinstalled around the perimeter of all four rearing lakes to deter wading bird predation. USDA APHIS staff conducts bird hazing under contract, but has not been able to keep a continual presence against predation.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

No listed fish are propagated in this program, but Cowlitz Hatchery Complex staff are available 24/7 ready to react to system failure and staff have emergency procedures and plans in place. All systems are alarmed to alert staff of failure.

CSH. During trapping season, tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to any listed adult fish.

The hatchery has two back-up generators located in separate sheds and one backup generator in the basement for the recirculation systems and sump pumps installed during the remodel of the hatchery. The 1.5 KBW generator with upgraded switching equipment is capable of supplying power with sufficient capacity to operate the two-200 hp pumps and two of the 600 hp pumps along with the residences in the event of a power outage. Tacoma Power has retained the 600 KW generator and switching equipment which would bring on one river pump in case the new generator should ever fail. Tacoma Power staff maintains the facility and with the Washington Department of Fish and Wildlife staff they test the emergency systems weekly. In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery and on-station WDFW staff will respond to these alarms 24/7 with assistance from Tacoma Power staff if necessary.

At the stress relief ponds (SR's), a river water supply shunt valve was installed in 1999 to bypass the de-nitrification columns to provide water during the time the auxiliary power is being used. During the remodel of the hatchery a larger river water supply valve was also installed off of the primary ring header supply line to provide more water down to the SR's if needed.

CTH. Safeguards to insure an uninterrupted water supply at the Cowlitz Trout Hatchery include auxiliary power to supply the four river water intake pumps, the south wells, the north well building; well not currently in use/hatchery building / alarming system, and the ozone plant. All water sources and head boxes of all raceways are equipped with low water alarms. The water intake structure also has an alarm for the river water, south well water and the north well water. All wells and river pumps are also alarmed. During the year 2000 (December), auxiliary power backup was provided to the south wells.

The river water is a source of numerous pathogens. This water is disinfected by the ozone plant during May through December. Since water is re-used (3rd use) between numerous ponds the

possibility for the spread of infection is there. Normal fish culture hygiene is practiced. Flooding and muddy water occasionally occurs even though the river level is controlled by three dams.

IHOT (1995) fish health guidelines are followed; adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of any fish disease or pathogen transfers. WDFW fish health specialists conduct inspections monthly and problems are managed promptly.

6 SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1 Source.

The program utilizes locally-adapted hatchery-origin early-summer steelhead adults returning to the Cowlitz Salmon Hatchery separator.

6.2 Supporting information.

6.2.1 History.

Early summer steelhead are not native to the Cowlitz River; broodstock for the summer steelhead originally came from the Skamania Hatchery stock (a mixture of Washougal and Klickitat river summer steelhead). Historical Washington Department of Game (WDG) hatchery records show that summer steelhead fry and smolts were planted into the Cowlitz River between 1936 and 1967, prior to the construction of the Cowlitz Trout Hatchery. Steelhead plants before 1957 were small and comprised of multiple stocks. Less than 50,000 smolts were planted annually from 1957 to 1967, (WDG 1986); an average of 67,511 juvenile steelhead were collected annually at the Mayfield fish passage facility, between 1964 and 1966, (Thompson and Rothfus 1969).

The Cowlitz River Fisheries and Hatchery Management Plan proposes to operate hatchery programs rearing non-native salmonid species as Segregated (FHMP update 2011). This program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish. To reduce interactions between hatchery and ESA-listed fish, hatchery production for all species, production figures throughout the 35-year re-licensing term in the remodeled facility (CSH - completed in 2010) will be reviewed annually with the Fisheries Technical Committee.

6.2.2 Annual size.

Up to 900 adults are collected to ensure run and egg timing and adequate numbers of brood survival at time of spawning.

Table 6.2.2.1: Total summer steelhead adult returns to Cowlitz Hatchery facilities.

Year	Hatchery	Unmarked
2002	5,533	n/a
2003	10,940	560
2004	6,109	6
2005	13,161	0
2006	4,972	0
2007	10,521	0
2008	2,747	0
2009	8,492	8
2010	6,202	10
2011	8,953	7
2012	7,039	13

2013	10,593	23
Average	**7,939**	**57**

Source: WDFW Annual Escapement Reports.

6.2.3 Past and proposed level of natural fish in broodstock.

Currently, the summer steelhead program uses only marked adults returning to the hatchery; no natural fish have been incorporated in the broodstock.

The Cowlitz River Fisheries and Hatchery Management Plan proposes to operate hatchery programs rearing all non-native species as Segregated (The Cowlitz River Project, FERC No. 2016, August 2000).

6.2.4 Genetic or ecological differences.

Early summer steelhead are not native to the Cowlitz River. Broodstock for the summer steelhead program originally came from a mixture of Washougal and Klickitat River summer steelhead. Currently, the summer steelhead program uses only marked adults returning to the hatchery; no natural fish have been incorporated in the broodstock

Genetic characteristics (allozyme data) of the winter-late hatchery stock were distinctive compared to the non-native Cowlitz Hatchery winter-early and summer-run stocks, and to other Lower Columbia population samples (Phelps et al. 1997). The Cowlitz summer-run stock was derived from the Skamania Hatchery summer stock. This stock was produced to mitigate for the loss of fish due to hydroelectric dams on the Cowlitz River.

A genetics study conducted by Small et al. (2010) found that:

Cowlitz hatchery stocks are genetically distinct among themselves, such that 95% of fish assign back to their stock of origin with high probability. The hatchery stocks were genetically distinct among themselves and if only fish with greater than 90% relative likelihood of assignment are considered, 95 to 100% of fish assigned back to their stock of origin with high probability. If all fish sampled per broodstock are considered (positively assigned with 90% relative likelihood and ambiguously assigned with less than 90% relative likelihood), the percentage of fish assigning back to their stock of origin changed to: 88% for Cowlitz Hatchery late-winter-run; 86% for Cowlitz Hatchery summer-run; 79% for Cowlitz Hatchery early-winter-run.

Cowlitz hatchery stocks are genetically distinct from other lower Columbia hatchery stocks and wild populations. The three Cowlitz Hatchery stocks were distinct from the eleven wild or natural-origin steelhead population samples WDFW had for testing. WDFW did not have samples from any other lower Columbia region hatcheries to test.

6.2.5 Reasons for choosing.

This stock was chosen to provide harvest opportunity.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Broodstock is collected from adipose fin-clipped hatchery-origin steelhead collected at the hatchery complex between July 1 and September 30.

7 SECTION 7. BROODSTOCK COLLECTION

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Adult hatchery-origin summer steelhead marked with an adipose clip arriving at Cowlitz Salmon Hatchery.

7.2 Collection or sampling design.

The adult brood is trapped at the Cowlitz Salmon Hatchery separator and routed to adult holding ponds for broodstock and/or surplus. Summer steelhead broodstock is collected from July 1 through September 30.

Fish are sorted by species, sex, new, previously recycled, natural (unmarked) and as infrequently as possible to avoid unnecessary stress. All fish are randomly selected for spawning and excess fish are surplus and donated to the food banks.

Mature fish needed for spawning are crowded into the Adult Handling Building. Once fish are crowded a select number are placed into the electro-anesthesia basket. From the electro-anesthesia, mature males and females are killed and placed on a drying rack to collect the eggs while green or not mature fish are returned to the adult pond.

7.3 Identity.

Early summer steelhead are identified by run timing. Hatchery-origin summer steelhead have been mass-marked (adipose-fin clip) since 1984. Natural-origin fish are very rare, but are returned to the river when encountered (see **Table 6.2.2.1**).

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

Up to 900 adults at a female to male 1:1 ratio with a fecundity approximately at 4,200 eggs per female to meet egg program goals. Adults are collected to ensure run and egg timing and adequate numbers of brood survival at time of spawning.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2.1: Total broodstock collected for Cowlitz summer steelhead 2001-2012.

Year	Females	Males	Jacks
2001	789*		1
2002	228	228	0
2003	180	180	0
2004	197	206	0
2005	210	210	0
2006	219	222	0
2007	190	193	0
2008	194	194	0
2009	179	179	0
2010	178	177	0
2011	258	258	0
2012	240	243	0

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014.
* Unable to break-out sex.

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

All adults collected at Cowlitz Salmon Hatchery are visually sampled, sexed and sorted. Steelhead adults that are above hatchery needs are either recycled to the lower Cowlitz River for additional sport opportunity or donated to food banks.

Table 7.5.1: Disposition of summer steelhead returning to the Cowlitz Hatchery Complex.

Return Year	Plant	Trap/Holding Mortality	Ship	Surplus	Spawn
2007	9,074	169	817	212	383
2008	11	57	918	1,354	388
2009	8	213	2,006	5,893	358
2010	16	82	1,121	4,601	355
2011	8	297	0	8,300	516
2012	13	180	0	6,335	483
2013	327	321	19	9,459	388
Average	**1,351**	**188**	**697**	**5,165**	**410**

Source: WDFW Hatcheries Headquarters Database 2014.

7.6 Fish transportation and holding methods.

Cowlitz Salmon Hatchery. Adult fish transported from the Cowlitz Salmon Hatchery fish separation unit are held in one of six 643-cu.ft circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. The facility has two 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low-stress transfer for the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river.

Cowlitz Trout Hatchery. Adult trapping at CTH was discontinued in 2007 with the exception of anadromous coastal cutthroat that are collected at either of the two hatchery outfalls and transported to Cowlitz Salmon Hatchery.

See also HGMP section 5.3.

7.7 Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT), *Pacific Northwest Fish Health Protection Committee* (PNFHPC), WDFW's *Fish Health Manual* (November 1966, updated March 1998, revised March 2010) or Co-manager guidelines are followed. The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection including chlorine, Virkon® or iodophor procedures upon entering or exiting the area. Formalin treatments are administered if needed.

Table 7.7.1: Mortality rates of adult summer steelhead returning to the Cowlitz Hatchery Complex.

Return Year	Trap/Holding Mortality	Total Return	% Mortalities
2007	169	10,521	1.61%
2008	57	2,747	2.07%
2009	213	8,500	2.51%
2010	82	6,212	1.32%
2011	297	8,960	3.31%
2012	180	7,052	2.55%
2013	321	10,616	3.02%
Average	**188**	**7,801**	**2.42%**

Source: WDFW Hatcheries Headquarters Database 2014.

7.8 Disposition of carcasses.

Spawned carcasses of summer-run steelhead are considered inedible and are buried. Carcasses are not used in nutrient enhancement, primarily for disease (IHNV) concerns.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Early summer steelhead broodstock is selected from mass-marked adults returning to the Cowlitz Salmon Hatchery. Unmarked fish collected at the separator are returned to the river in a manner designed to minimize harm. The spawn timing of this hatchery stock has been advanced over three months since it was first developed in the 1950s. The early spawn timing decreases the potential for mixing between summer steelhead and winter-late steelhead on the spawning grounds and has also decreased successful natural-spawning of the hatchery fish.

8 SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1 Selection method.

Adults are collected at the Cowlitz Salmon Hatchery separator from July 1 through September 30. This time frame reduces the chance of mixing summer steelhead with late-arriving winter-late steelhead (June) or early-arriving winter steelhead (October), and staff can distinguish stocks by coloration. All selection is random.

Individuals selected and spawned are randomly from females ripening after December 1; females ripening prior to December 1 are rejected. There will be no selection for size. Spawning will occur from December (50%) through January (50%), and will be completed by January 31. It has been difficult to achieve a 50% January egg-take, as most females ripen in December. Spawning generally occurs weekly.

8.2 Males.

All hatchery steelhead, males are randomly selected and lethal spawned. There will be no selection for size.

8.3 Fertilization.

All spawning has been 1:1 ratio male to female. Milt is added to eggs from one female, then after five minutes, the fertilized eggs are disinfected and water-hardened in an iodine solution for one hour then incubated. Incubation operations for all steelhead stocks take place at the Cowlitz Salmon Hatchery on recirculation systems A & B in vertical stacks.

8.4 8.4) Cryopreserved gametes.

This program does not use cryopreserved gametes.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Males and females available are mated randomly. Natural (unmarked) fish will not be used in the broodstock.

9 SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1 Incubation:

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1.1: Survival rates (%) from egg-take to ponding, Cowlitz River early summer steelhead.

Year	Egg-Take	% Survival	
		Green-to-Eyed Eggs	Eyed Egg-to-Ponding
2001	1,113,400	85.8	N/A
2002	887,693	91.2	95.3
2003	789,232	92.7	98.9
2004	837,451	90.7	96.7
2005	842,005	92.6	96.7
2006	872,693	93.2	96.3
2007	839,414	90.0	94.0
2008	843,338	87.7	97.4
2009	783,636	88.6	97.3
2010	786,536	92.8	97.3
2011	820,837	88.4	95.7
2012	1,011,117	86.6	98.2
2013	988,061	82.8	96.5
Average	**878,109**	**89.5**	**96.7**

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014.
NA – Not available.

9.1.2 Cause for, and disposition of surplus egg takes.

There are no surplus of eggs taken to meet program goals. Annually the program is monitored and scrutinized for accuracy based on the average survival of prior brood years.

9.1.3 Loading densities applied during incubation.

Currently the incubation of eggs at the CSH takes place in recirculation systems A&B egg trays. Eggs from hatchery stock are incubated in two-fish pools in egg trays and are laid down to eye and hatch at 10,000 eggs per tray.

9.1.4 Incubation conditions.

Cowlitz Trout Hatchery. The facility has 88 shallow trough incubators which are supplied by well water which are not currently being used. Five new gas diffusers, packet columns were installed in 2002 to correct the supersaturated gas and low oxygen levels from the north well (primary incubation supply) and south well water supply. Temperature of the wells water normally runs 48 - 50°F. The north well was inundated with bacteria thus has not been utilized since fall 2000. Tacoma Power installed an auxiliary power generator to the south wells.

Cowlitz Salmon Hatchery. Currently the incubation of eggs is done at the CSH recirculation systems A&B egg trays. The incubation of steelhead stocks in vertical stacks/egg trays on Recirculation Systems A&B on ground water via once thru mode (fresh supply) or on recirculation mode (reclaimed supply with added fresh or makeup supply). Flow, temperature and dissolved oxygen readings are monitored.

9.1.5 Ponding.

Cowlitz Trout Hatchery. Currently not being used. The Cowlitz Trout Hatchery has 88 shallow troughs where sac fry merge from the egg baskets. Ponding or feeding is initiated for steelhead at 1,200 temperature units (TU's) when unfed fry are about 2,500 fish per pound (fpp) and for cutthroat at 1,050 TU's when unfed fry are about 6,500 fpp. Ponding begins in mid-February continuing into March, and is based on visual inspection of the amount of yolk remaining. Flow, temperature and dissolved oxygen readings are monitored.

Cowlitz Salmon Hatchery. Currently at the CSH, recirculation systems A&B, all steelhead and cutthroat programs are ponded as unfed fry from incubation egg trays to the rearing troughs. Ponding or feeding is initiated for steelhead at 1,200 temperature units (TU's) when unfed fry are about 2,500 fish per pound (fpp) and for cutthroat at 1,050 TU's when unfed fry are about 6,500 fpp. Ponding begins in mid-February continuing into March and is based on visual inspection of the amount of yolk remaining. Flow, temperature and dissolved oxygen readings are monitored.

9.1.6 Fish health maintenance and monitoring.

Cowlitz Trout Hatchery. Feeding fry diseases include Bacterial Cold Water Disease (BCWD) and *Trichodina*. Standard fish health protocols are followed as defined in the *Fish Health Manual* (WDFW revised March 2010).

Cowlitz Salmon Hatchery. Unfed and feeding fry diseases on recirculation systems A&B include Bacterial Cold Water Disease (BCWD), Bacterial Gill Disease (BGD) and gut fungus. Standard fish health protocols are followed as defined in the *Fish Health Manual* (WDFW revised March 2010).

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally.

Only hatchery-origin fish are incubated. Backup generator systems are on-site to provide power for hatchery water supplies in the event of power loss at both the Cowlitz Salmon and Cowlitz Trout Hatcheries.

9.2 Rearing:

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Table 9.2.1.1: Survival rates (%) from ponding to release, Cowlitz hatchery summer steelhead.

Year	Population Ponded	Fry-to-Smolt Survival (%)
2001	846,025	91.1
2002	844,167	30.4
2003	692,787	68.9
2004	702,796	28.9
2005	712,343	73.9
2006	740,032	68.1
2007	654,662	83.7
2008	638,779	82.7
2009	641,337	88.6
2010	669,304	86.3

2011	681,133	84.1
2012	850,989	79.2
Average	**722,863**	**72.2**

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014.

9.2.2 Density and loading criteria (goals and actual levels).

Table 9.2.2.1: Density and loading levels in Cowlitz Trout Hatchery rearing ponds.

Stage	Container		Loading		Water	
	Type	Size	Number Fish	Size (fpp)	Flow (gpm)	Quality
Starting	Concrete trough	7.2 cu. ft.	20,000	2,500	10	One pass
Initial Rearing	Concrete raceways	10'x80'	200,000	1,500	200	One pass
		20'x100'	400,000	700	300	Fresh and re-use
Final Grow-out	Rearing ponds	5.0-acre	350,000	5.5	5,000	Fresh and re-use
		2.5-acre	350,000	8.0	5,000	
	Concrete raceway	20'x 100'	35,000-40,000	5.5	900	Re-use

Cowlitz Trout Hatchery. Fish are started in concrete troughs with 7.2 cu. ft. of water capacity, loaded with an average of 20,000 fry and steelhead at 2,500 fpp and cutthroat at 6,500 fpp. Initial rearing occurs in either the 10' X 90' or 20' X 90' concrete raceways, with final grow-out in the 20-ft raceways and 5.0-acre or 2.5-arce acre rearing ponds. The 10-ft wide raceways are started with up to 200,000 fish at 1,500 fpp. Twenty-foot wide raceways are started with 400,000 fish maximum at 700 fpp; as fish increase in size, the numbers are reduced to a final loading number of 6,000 pounds of fish per 20-ft wide raceway. Loading is 65,000 pounds of fish in the 5.0-acre lakes and 45,000 pounds of fish in the 2.5-acre lake.

Table 9.2.2.2: Density and loading levels in Cowlitz Salmon Hatchery rearing ponds.

Stage	Container		Loading		Water	
	Type	Size (cu. ft.)	Number Fish	Size (fpp)	Flow (gpm)	Quality
Starting Recirculation Systems A&B	Rearing trough-9	477	150,000	2,500 & 6,500	90	Recirculation supply
	Rearing trough-3	152	40,000	2,500 & 6,500	45	Recirculation supply & One pass

Cowlitz Salmon Hatchery. On recirculation systems A&B fish are started, steelhead at 2,500 fpp, and initial reared in fiberglass troughs. The nine larger rearing troughs have 477 cu-ft. of water capacity, loaded with an average of 150,000 fry and the 3 smaller troughs at 40,000 fry. Once flow and density indexes are met in the rearing vessels the fish stocks are either split to adjacent troughs or the fish are transported to the Cowlitz Trout Hatchery to complete initial rearing and final grow out.

9.2.3 Fish rearing conditions.

Cowlitz Trout Hatchery. Water flow in the shallow troughs is 10 gallons per minute (gpm). Water is one-time pass-through in the 10-ft wide raceways, but 20-ft wide raceways may use re-use water. Raceways and rearing ponds receive both fresh and previously-used water.

Due to dependence on limited ozonated and well water during a significant period of the rearing cycle (mid-May through late December), water must be re-used multiple times to achieve production goals. During the final grow out period, January to mid-May the facility operates on all four river pumps and all raceways receive fresh water and the rearing ponds receive both fresh

and previously-used water. Oxygen levels are normally greater than 10 ppm with incoming river water. Water temperatures range between 40-54°F.

Raceways are cleaned on average once per week throughout their rearing. The rearing ponds have a settling basin that is cleaned once by divers via septic tank truck within one week from final drawdown. The effluent of both goes into a pollution abatement pond.

Cowlitz Salmon Hatchery. Fish numbers ponded into the rearing troughs are based on density and flow indexes at maximum growth. If or when density and/or indexes are met the fish are either split into adjacent troughs or transferred to the Cowlitz Trout Hatchery. Flows are increased by fish size and growth to optimize feeding and cleaning conditions. Water supply in the rearing troughs is operated normally in recirculation mode. If treatments (excluded medicated feed) are administered, such as hydrogen peroxide, the recirculation system has to be switched to the one pass flow and routed to the plant drain. The administered chemical would destroy the bacteria in the recirculation system (sand filters) that removes ammonia toxins. During the highest demand and/or loadings there is not enough well water supply for one pass for a sustained period of time. Toughs are cleaned daily; waste is discharged to the sand filters via internal plumbing and flushed to the pollution abatement pond every other day or daily dependent on loadings. Flow, temperature, dissolved oxygen and water quality readings are monitored daily.

9.2.4 Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4.1: Monthly fish growth, by length (mm), weight (fpp), condition factor and growth rate, Cowlitz summer steelhead.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
February at Ponding	NA	2,000	NA	NA
March	42.4	600	3.733 E-04	0.700
April	50.0	350	3.334 E-04	0.417
May	61.5	200	3.391 E-04	0.429
June	81.8	85	3.791 E-04	0.575
July	98.6	40	4.175 E-04	0.529
August	117.7	25	4.189 E-04	0.375
September	129.6	18	3.965 E-04	0.280
October	142.8	15	4.019 E-04	0.167
November	150.8	12	4.344 E-04	0.200
December	157.9	10	4.162 E-04	0.167
January	166.3	8	4.098 E-04	0.200
February	183.9	7	4.113 E-04	0.125
March	191.6	6	4.020 E-04	0.143
April	200.3	5	4.164 E-04	0.167

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See **Table 9.2.4.1**.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Table 9.2.6.1: Food type and feeding rate, by rearing period.

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
Swim-up fry	Mash #1	7	4.0		0.5
Fry	#1 and #2 crumble	7	2.5-4.0		0.6
Fingerling	1.2 mm and 1.5 mm	6	1.5-3.0		0.7
Yearling	2.0 mm	5	1.0-3.0		0.8
Smolt	2.5 mm	5	1.0-3.0		1.1

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a WDFW Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the Fish Health Specialist. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), *Fish Health Policy in the Columbia Basin* and *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995). A fish health specialist stationed at the Cowlitz Hatchery Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted. All eggs brought to the facility are surface-disinfected with iodophor, per disease policy guidelines.

In the standard raceways, fry and fingerlings have been treated with florfenicol oral application for Bacterial Cold Water Disease (BCWD), hydrogen peroxide for external BCWD and Bacterial Gill Disease, and Parasite-S for external parasites on juveniles, fungus and *Trichodina* control in adults. Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause severe mortality to fry/fingerlings and low-level chronic mortalities on yearling/smolts during the rearing period. Formalin drip treatments may also prescribed after marking to control fungus from infecting the clipped area. Fish health and/or treatment reports are kept on file.

The lower Cowlitz River appears to harbor the polychaete worm, an intermediate host *Ceratomyxa shasta*, which causes *Ceratomyxosis*. *C. shasta* may become established by the introduction of infected fish or infective water into the area wherever this worm exists. Wild and hatchery fish may contract this disease as they migrate through the lower river. Mortalities are collected and disposed of at a landfill. Fish health and/or treatment reports are kept on file.

All equipment (nets, tanks, boots, etc.) are disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation unit, with the intent of preventing the horizontal spread of pathogens. Tank trucks are disinfected between the fish transports. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

See also HGMP section 10.9 for WDFW Standard Fish Health Procedures.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development. ATPase activity is not measured.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

No "NATURES" type rearing methods are currently applied through the program, although there have been previous efforts in the past (see HGMP section 11).

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

An ozone water sterilization plant is available for use during portions of the year. The plant has a 20 cfs maximum design capacity. The purpose of this plant is to reduce the mortality and poor growth of fish associated with *Ceratomyxa shasta* (*C. shasta*) infection.

Hatchery fish are reared to meet *Statewide Steelhead Rearing and Release Guidelines* (Tipping 2001) to achieve a size and condition factor at the time of releases that represents the best chance for survival in order to meet adult goals. Rearing fish to a yearling smolt stage is mandatory in order to foster out-migration and subsequent survival when the fish vacate the system. Fry or sub-yearlings will not be reared and released from this program in order to eliminate or minimize interactions with listed fish rearing in the system.

All reasonable and prudent measures are employed to minimize rearing and incubation losses. These include the use of well water for incubation and early rearing of fry, high quality feeds for rearing, rearing densities and loadings that conform to best management practices, frequent fish health inspections and presence of professionally trained personnel to operate facilities. Hatcheries are designed to provide safe and secure rearing environment through the use of alarm systems, backup generators and water re-use pumping systems to prevent catastrophic fish losses.

10 SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1 Proposed fish release levels.

Table 10.1.1: Proposed release levels.

Age Class	Max. No.	Size (fpp)	Release Date	Stream Location
Yearling	650,000	5.5	Apr - May	Cowlitz River*

Source: WDFW Future Brood Document 2014.
Note: 5.5 fpp = 204 mm fork length (fl).
FOC releases were discontinued in 2012.
* Released into Blue Creek (WRIA 26.0527) at RKm 0.8, tributary to the Cowlitz River at RKm. 66.1.

10.2 Specific location(s) of proposed release(s).

Stream, river, or watercourse:	Cowlitz River (WRIA 26.0002)
Release point(s):	RKm 66.0
Major watershed:	Cowlitz Sub-Basin
Basin or Region:	Lower Columbia River

10.3 Actual numbers and sizes of fish released by age class through the program.

Table 10.3.1: Number, size, CVs and date released, Cowlitz River early summer steelhead yearlings, by program, 2002-2013.

Release Year	Friend of the Cowlitz				Cowlitz Hatchery			
	Number	Avg. Size (fpp)	CV	Date Released	Number	Avg. Size (fpp)	CV	Date Released
2002	90,749	5.2	8.61	Apr 16-18, May 13	523,478	5.2	9.09	Apr 18-30, May 1-15
2003	72,294	6.1	10.29	Apr 16, 30	158,679	4.6	10.00	Apr 21-28
2004	98,622	4.8	8.69	Apr 15, 19	378,602	5.0	8.51	Apr 15-25
2005	18,096	4.6	7.84	Apr 19	184,764	5.5	8.75	Apr 15-21
2006	99,073	5.2	8.03	Apr 17, 20	427,158	5.5	8.39	Apr 15-21
2007	97,906	5.8	9.01	Apr 15, 23	404,848	7.0	8.53	Apr 16, May 1-15
2008	100,520	4.8	8.178	Apr 15, 28	446,585	6.2	9.37	Apr 15-30, May 1-20
2009	94,124	6.3	7.738	Apr 20, 27	466,489	6.3	8.80	Apr 15-30, May 1-20
2010	100,529	4.7	8.554	Apr 20, May 3	467,354	4.7	9.50	Apr 15-May 20
2011	100,524	4.9	10.158	Apr 20, May 4	477,098	6.2	9.32	Apr 15-30, May 1-17
2012	100,000	7.0	13.352	Apr 16, 25	471,529	6.6	9.47	Apr 15-30, May 1-15
2013	**Discontinued**				673,578	5.9	10.71	Apr 15-May 20

Source: WDFW Hatcheries Headquarters Database 2014.
Note: 5.5 fpp ~205 mm fork length (fl); 7.0 fpp ~188 mm fl.

10.4 Actual dates of release and description of release protocols.

See **Table 10.3.1** for actual dates.

Releases begin April 15 and are completed by May 20. Releases start volitionally. All four ponds share a common counting structure, and therefore must share the release period to enumerate species, and/or races. Remaining fish that did not leave volitionally are forced out after the lakes are lowered and drained in late May. Direct releases from the Cowlitz Trout Hatchery raceways are not possible, and fish must be trucked out.

In previous years, the "Friends of the Cowlitz" (FOC) sports group received 100,000 fish in February and March to acclimate in net pens in Wallace Ponds and at the Toledo Sand and Gravel Pit for release to the lower river (**Table 10.3.1**). This program was discontinued in 2012.

10.5 Fish transportation procedures, if applicable.

See HGMP section 5.2.

Tacoma Power has three 1,500-gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving juvenile fish through the displacement of water. All transport trucks have oxygen and recirculation systems. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon fiberglass tank and several 250 gallon tanks) are utilized for moving fish around and between the facilities.

10.6 Acclimation procedures (methods applied and length of time).

Cowlitz Trout Hatchery.

Smolts are reared from fry of hatchery-origin stock and are directly-released adjacent to the rearing ponds. South well water supply fry from March to May and emergency supply the remainder of the year. River water is pumped year round with ozone treatment of river water from late May into December then raw river water supplies yearling smolts from January to release.

See also HGMP section 5.6.

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All fish are mass-marked (adipose fin-clipped) prior to release. The hatchery evaluation biologist may apply additional marks or tags to identify specific groups for research.

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

The program guidelines for annual broodstock/egg-take collection are managed to prevent any surpluses, and maintained within the ±5% guideline. In the event of surplus >10%, WDFW Regional Managers will in accordance with regional policy and guidelines set forth in management plans/agreements and ESA permits, and after consultation with NMFS, instruct hatchery staff for disposition of the surplus.

10.9 Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

- *All fish health monitoring is conducted by a qualified WDFW Fish Health Specialist.*
- *Juvenile fish examinations are conducted at least monthly and more often if necessary*. A representative sample (at the discretion of the fish health specialist) of healthy and moribund fish from each lot is examined.
- *Abnormal levels of fish loss are investigated if they occur.*
- *Fish health status is determined prior to release or transfer to another facility*. The exam may occur during the regular monthly monitoring visit, i.e. within one month of release or transfer.
- *Appropriate actions, including drug or chemical treatments are recommended as necessary*. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile is generated when possible.
- *Findings and results of fish health monitoring are recorded on a standard fish health reporting form and maintained in a fish health database.*
- *Fish culture practices are reviewed as necessary with facility personnel*. Where pertinent; nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures and treatments are discussed.

10.10 Emergency release procedures in response to flooding or water system failure.

In the case of a catastrophic event, conditions critical to the fish's health would be monitored, however, fish would not be purposely released during flooding unless the water system failed. At the Cowlitz Trout Hatchery, fish in the raceways cannot be released directly into the river, and would need to be pumped to trucks or to the river; time would be limited due to the large number of ponds.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

This program follows guidelines from the *Integrated Hatchery Operations Team* (IHOT), *Pacific Northwest Fish Health Protection Committee* (PNFHPC), WDFW's *Fish Health Manual* (November 1966, updated March 1998, revised March 2010) and/or Co-manager.

WDFW has taken following actions to minimize adverse genetic and ecological effects to listed species resulting from hatchery releases:

- Eliminated egg transfers between watersheds.
- Eliminated egg-takes after January 31, to keep hatchery and natural populations temporally segregated.

- Eliminated off-station releases where no trapping facilities are available.
- Reduced recycling fish back into the river for sport fishing opportunities.
- Eliminated fry and sub-yearling releases, and mandatory rearing; release only yearling smolts, which are in migratory condition. This promotes rapid out-migration and thus minimizes the time spent in the river, in order to minimize or eliminate interactions with natural-origin salmonids rearing in the system (*Statewide Steelhead Rearing and Release Guidelines*; Tipping 2001).
- Promoted volitional releases to foster rapid seaward migration and limit freshwater interactions with listed Chinook and steelhead juveniles, bull trout and other naturally-produced salmonids.
- Mass-mark all releases for harvest selection and removal from the system.
- Release fish no earlier than April 15, to allow listed stocks (Chinook, chum and steelhead) and pink salmon, to emigrate out of the system, and/or provide time for additional growth to minimize potential predation.
- Continue monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with wild fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on wild fish.

Hatchery steelhead releases have been 100% mass-marked since 1980s to enable identification during selective harvest, broodstock selection and, most recently, removal from the system.

WDFW continues monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with natural-origin fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on natural-origin fish. WDFW is conducting research on the effects of volitional releases in Upper Columbia basin. This study is not yet fully completed, but preliminary results suggest faster fish migration, and lower rates of residualism when released volitionally (Snow et al. 2013).

With changes already being implemented, WDFW continues monitoring its hatchery programs and the affected watersheds to observe the effects on the populations at the hatcheries and natural spawning grounds.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Table 11.1.1 is from the FHMP update Appendix J - Monitoring and Evaluation Plan: Analytical Methods and Monitoring Activities of the FHMP, see attached Appendix J for additional information on specific monitoring activities.

Table 1.11.1: Monitoring activities that will provide the data (measure) that support the analysis for one or more populations in the project area.

Code	Name/Description	Analytical Methods Supported	Application (Populations)
MA-A	Carcass/Redd Surveys	AM-1, AM-2	LC: FCH, COH, STHD
MA-B	Juvenile Trapping	AM-1, AM-9, AM-10, AM-14	LC: FCH, COH, STHD, CUT
MA-C	Creel Survey	AM-4, AM-5	All Populations
MA-D	Catch Record Cards	AM-3, AM-4, AM-5, AM-11	LC: FCH, COH, STHD, SPC
MA-E	Hatchery Brood Bio-sampling	AM-6	LC: FCH, COH, STHD, SPC UC: COH, SPC
MA-F	In-hatchery Monitoring	AM-7	All hatchery programs
MA-G	Juveniles at Cowlitz Falls	AM-12	UC: COH, STHD, SPC, FCH
MA-H	Juveniles at Mayfield	AM-13	TIL: COH, STHD, SPC
MA-I	Adults at Separator	AM-11	UC: COH, STHD, SPC, FCH TIL: COH, STHD, SPC
MA-J	Weir Operation	AM-1b	LC: COH, STHD

Source: FHMP – Appendix J 2011.

WDFW Enhancement Co-ops follow a mandatory MOU; annual Volunteer Fish Production Project Records are tracked. WDFW use the results to determine and evaluate enhancement co-op contribution of smolts and adults to the system.

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

See HGMP section 11.1.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Tacoma Power and WDFW fund the lower Cowlitz River monitoring programs.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS-222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

There is no current research associated with this program.

12.2 Cooperating and funding agencies.

Not applicable.

12.3 Principle investigator or project supervisor and staff.

Not applicable.

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not applicable.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Not applicable.

12.6 Dates or time period in which research activity occurs.

Not applicable.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable.

12.8 Expected type and effects of take and potential for injury or mortality.

Not applicable.

12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Not applicable.

12.10 Alternative methods to achieve project objectives.

Not applicable.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Not applicable.

13 SECTION 13. ATTACHMENTS AND CITATIONS

Becker, C.D. 1973. Food and growth parameters of juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387-400.

Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Scit. 53: 164-173.

Cannamela, D.A. 1993. Hatchery steelhead smolt predation of wild and natural juvenile chinook salmon fry in the upper Salmon River, Idaho. Idaho Department of Fish and Game, Boise, ID.

Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Dawley, E. M., R.D. Ledgerwood, T.H Blahm, R.A. Kirn, and A.E. Rankis. 1984. Migrational Characteristics And Survival Of Juvenile Salmonids entering the Columbia River estuary During 1983. Annual Report to the Bonneville Power Administration, Portland, OR.

Dornbusch, P. and A. Sihler. 2013. ESA recovery plan for Lower Columbia River coho salmon, Lower Columbia River Chinook salmon, Columbia River chum salmon, and Lower Columbia River steelhead. National Marine Fisheries Service. Northwest Region, Portland, Oregon. 503 pp.

Easterbrooks, J. 1980. Salmon production potential evaluation for the Cowlitz River system upstream of the Cowlitz Falls Dam site. Washington Department of Fisheries.

FERC (U.S. Federal Energy Regulatory Commission). 2000. Cowlitz River Hydroelectric Project Settlement Agreement. United States of America Federal Energy Regulatory Commission.

FERC (U.S. Federal Energy Regulatory Commission). 2002. Order Approving Settlement and Issuing New License. City of Tacoma, WA. Project No. 2016-044. United States of America Federal Energy Regulatory Commission. 98 FERC ¶ 61, 274

Fisheries and Hatchery Management Plan (FHMP). 2004. Tacoma Power. Fisheries and Hatchery Management Plan *Final*. Cowlitz River Project FERC No. 2016.

Fisheries and Hatchery Management Plan (FHMP) Update 2011. Tacoma Power. Cowlitz River Project FERC No. 2016.

Ford, M.J. (ed.). 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-113, 281 p.

Fuss, H.J., J. Byrne, and C. Ashbrook. 1998. Migratory Behavior and Incidence of Post-Release Residualism of Hatchery Reared Coho and Chinook Salmon Released into the Elochoman River, WDFW Annual Report FPA99-08.

Good, T.P., R.S. Waples, and P. Adams, (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department Commerce. NOAA Tech. Memo. NMFS-NWFSC-66.

Harza. The 1997 and 1998 technical study reports, Cowlitz River Hydroelectric Project. Vol. 2, 35-42.

Harza 2000. Lower Clark Fork River Fish Transport Plan. Final Report to Avista Corp.Portland, Oregon, 32 pgs.

Hawkins, S.W., Tipping, J. M. 1999. Predation By Juvenile Hatchery Salmonids on Wild Fall Chinook Salmon Fry in the Lewis River, Washington. California Fish and Game 85(3):124-129

Healey, M.C. 1980. The ecology of juvenile salmon in Georgia Strait, British Columbia. pp 203-229. In W.J. McNeil and D.C. Himsworth [eds.] Salmonid ecosystems of the North Pacific. Ore. State Univ. Press, Corvallis.

Healey, M. C. 1991. Life history of Chinook salmon. pp 311–394. In C. Groot and L. Margolis [eds.], Pacific salmon life histories. Vancouver, BC: University of British Columbia Press.

HSRG (Hatchery Scientific Review Group). 2004. Hatchery reform; principles and recommendations of the Hatchery Scientific Review Group. Long Live the Kings. Seattle, Washington. Available from: http://hatcheryreform.us/hrp_downloads/reports/hsrg_princ_recs_report_full_apr04.pdf

HSRG (Hatchery Scientific Review Group). 2009. Report to Congress on Columbia River Basin Hatchery Reform. Hatchery Scientific Review Group. Long Live the Kings. Seattle, Washington. http://hatcheryreform.us/hrp_downloads/reports/columbia_river/report_to_congress/hsrg_report_12.pdf.

HSRG (Hatchery Scientific Review Group). 2009. System-wide Report on Columbia River Basin Hatchery Reform. Hatchery Scientific Review Group. Long Live the Kings. Seattle, Washington. http://hatcheryreform.us/hrp/reports/system/welcome_showaction.

IHOT (Integrated Hatchery Operations Team). 1995. Operation plans for anadromous fish Production facilities in the Columbia River basin. Volume III - Washington. Annual Report 1995. Bonneville Power Administration, Portland, OR. Project Number 92-043. 536 pp.

Jonasson, B. C., R. W. Carmichael, and T. A. Whitesel. 1995. Residual hatchery steelhead: characteristics and potential interactions with spring Chinook salmon in northeast Oregon. Annual Progress Report, Contract 14-48-0001-93538, Oregon Department of Fish and Wildlife, Portland, OR.

Kostow, K., A. Marshall and S.R. Phelps. 2003. Naturally spawning hatchery steelhead contributes to smolt production but experience low reproductive success. Transactions of the American Fisheries Society 132: 780-790.

Kostow, K.E., and S. Zhou. 2006. The effect of an introduced summer steelhead hatchery stock on the productivity of a wild winter steelhead population. Transactions of the American Fisheries Society 135(3): 825-841.

LCFRB. 2010. Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. June 6, 2010. http://www.lcfrb.gen.wa.us/Recovery%20Plans/March%202010%20review%20draft%20RP/RP%20Frontpage.htm.

Lichatowich, J. A., and J. D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmonids. American Fisheries Society Symposium 1: 131-136.

Mathisen, O.A., P.L. Parker, J.J. Goering, T.C. Kline, P.H. Poe, and R.S. Scalan. 1988. Recycling of marine elements transported into freshwater systems by anadromous salmon. Verh. Int. Ver. Limnol. 23: 2249-2258.

McElhany, P., T.Bachman, C. Busack, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, C. Steward, and T. Whitesel. 2003. Interim report on viability criteria for Willamette and Lower Columbia Basin Pacific salmonids. Unpublished report. NOAA Fisheries.

McLean, J.E., P. Bentzen and T.P. Quinn. 2003. Differential reproductive success of sympatric, naturally spawning hatchery and wild steelhead trout (*Oncorhynchus mykiss*) through the adult stage. Canadian Journal of Fisheries and Aquatic Sciences 60(4): 433-440.

McLean, J.E., P. Bentzen, and T.P. Quinn. 2004. Differential reproductive success of sympatric, naturally spawning hatchery and wild steelhead, *Oncorhynchus mykiss*. Environmental Biology of Fishes 69: 359-369.

Mobrand Biometrics, Inc. August, 1999 Draft. The EDT Method. 9920 SW Bank Rd, Vashon, WA 98070. (206) 463 5003.

Muir, W.O. and R.L. Emmelt. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1-10.

Myers, J.M., C. Busack, D. Rawding, and A. Marshall. 2002. Identifying historical populations of chinook and chum salmon and steelhead within the Lower Columbia River and Upper Willamette River Evolutionarily Significant Units. May 10, 2002 Co-manager Review Draft. Willamette/Lower Columbia River Technical Recovery Team.

Nelson, T.C., M.L. Rosenau and N.T. Johnston. 2005. Behavior and survival of wild and hatchery-origin winter steelhead spawners caught and released in a recreational fishery. North American Journal of Fisheries Management 25:931–943.

NMFS (National Marine Fisheries Service). 1995. Juvenile fish screen criteria for pump intakes. Available from: http://www.nwr.noaa.gov/1hydrop/nmfscrit1.htm.

NMFS (National Marine Fisheries Service). 1996. Juvenile fish screen criteria for pump intakes. Available from: http://www.nwr.noaa.gov/1hydrop/pumpcrit1.htm.

NMFS (National Marine Fisheries Service). 2000a. A risk assessment procedure for evaluating harvest mortality of Pacific salmonids. National Marine Fisheries Service, Sustainable Fisheries Division, Northwest Region. May 30. 33pp.

NMFS (National Marine Fisheries Service). 2006. Endangered and threatened species: final listing determinations for 10 Distinct Population Segments of West Coast steelhead: Final Rule. Federal Register 71FR834.

NMFS (National Marine Fisheries Service). 2011a. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

NMFS (National Marine Fisheries Service). 2013. Endangered and Threatened wildlife; proposed rule to revise the code of Federal Regulations for species under the jurisdiction of the National Marine Fisheries Service. Federal Register 78FR38270.

NMFS SHIEER 2004, 70 FR 37160. June 28, 2005 - Final ESA listing determinations for 16 ESUs of West Coast salmon, and final 4(d) protective regulations for threatened salmonid ESUs; NMFS 2004. Salmonid Hatchery Inventory and Effects Evaluation Report (SHIEER). An evaluation of the effects of artificial propagation on the status and likelihood of extinction of west coast salmon and steelhead under the Federal Endangered Species Act. May 28, 2004. Technical Memorandum NMFS-NWR/SWR. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Portland, Oregon. 557p.

NPPC (Northwest Power Planning Council). 2001. Performance standards and indicators for the use of artificial production for anadromous and resident fish populations in the Pacific Northwest. Portland, Oregon. 19 pp.

Pearsons, T.N., G.A. McMichael, K.D. Ham, E.L. Bartrand, A. l. Fritts, and C. W. Hopley. 1998. Yakima River species interactions studies. Progress report 1995-1997 submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-64878-6

Phinney, D. 2006. Compendium of Water Rights documents for Hatcheries and Wildlife areas. Washington Department of Fish and Wildlife Habitat Program. Olympia, Washington.

Piper, R., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Fowler, J.R. Leonard, A.J. Trandahl, and V. Adriance. 1982. Fish Hatchery Management. United States Dept of Interior, Fish and Wildlife Service. Washington, D.C.

Reimers, P .E. 1973. The length of residence of juvenile fall chinook salmon in the Sixes River, Oregon. Fish. Comrn. Ore. Res. Briefs. 4:1-43.

Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian Predation on Juvenile Salmonids in the Lower Columbia River 1997 Annual Report. Bonneville Power Administration Contract 97BI33475 and U.S. Army Corps of Engineers Contract E96970049. 70 p.

Sager, P.M., and G.J. Glova. 1988. Diet feeding periodictiy, daily ration and prey selection of a riverine population of juvenile Chinook salmon, *Oncorhynchus tshawytscha*. J. Fish Biol. 33: 643-653.

Seidel, P. 1983. Spawning guidelines for Washington Department of Fish and Wildlife hatcheries. Washington Department of Fish and Wildlife. Olympia, Washington.

Sharpe, C., P. Topping, T. Pearsons, J. Dixon and H. Fuss. 2008. Predation of naturally-produced fall Chinook fry by hatchery steelhead juveniles in Western Washington Rivers. Fish Program, Science Division Washington Department of Fish and Wildlife. Olympia, Washington.

SIWG (Species Interaction Work Group). 1984. Evaluation of potential interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel, chairman and K. Fresh editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Dept. of Fish and Wildlife. Olympia, WA. 80 pp.

Snow, C.G., A.R. Murdoch and T.H. Kahler. 2013. Ecological and demographic costs of releasing nonmigratory juvenile hatchery steelhead in the Methow River, Washington. North American Journal of Fisheries Management 33:6 1100-1112.

Steward, C. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish; a synthesis of published literature. Idaho Cooperative Fish and Wildlife Research Unit. University of Idaho. Tech. Rpt. 90-1. Moscow, Idaho.

Thompson, J. and L. Rothfus. 1969. Biological observations of salmonids passing Mayfield Dam. Washington Department of Fisheries.

Tipping, J. 2001. Profile of a great hatchery steelhead smolt. WDFW Tech. Memo. Washington Department of Fish and Wildlife. Olympia, Washington. 7pp.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS. Washington Department of Fisheries (WDF). 1951. Planning Reports. Lower Columbia River Fisheries Development Program. Preliminary draft, August 1951. 211 p. + appendices. Washington Department of Fisheries. 1951.

Lower Columbia River fisheries development program. Cowlitz area, Washington. Washington Department of Fisheries and U.S. Fish and Wildlife Service. August.

Ward, B.R., D.J.F. McCubbing and P.A. Slaney. 2003. Evaluation of the addition of inorganic nutrients and stream habitat structures in the Keogh River watershed for steelhead trout and coho salmon. *In* Stockner J.G. (editor). Nutrients in salmonid ecosystems: sustaining production and biodiversity. American Fisheries Society, Symposium 34(1): 127-147.

Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT). 1992. 1992 Washington State salmon and steelhead stock inventory (SASSI). Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 212 pp.

WDFW (Washington Department of Fish and Wildlife) and WWTIT (Western Washington Treaty Indian Tribes). 1998 (Updated 2006). Salmonid disease control policy of the fisheries Co-Managers of Washington State. Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes, Olympia Washington.

WDFW (Washington Department of Fish and Wildlife). 2010. Draft Conservation and Sustainable Fisheries Plan (C&SFP). Washington Department of Fish and Wildlife. Olympia, Washington. 208 pp.

WDFW (Washington Department of Fish and Wildlife). 2010. WDFW Fisheries Management and Evaluation Plan (FMEP). Lower Columbia River. Submitted to NMFS Portland, Oregon.

WDFW. (Washington Department of Fish and Wildlife). 2013. Catch Record Card (CRC) database. Washington Department of Fish and Wildlife. Olympia, Washington.

WDFW (Washington Department of Fish and Wildlife). 2013. 2013 Future brood document. Washington Department of Fish and Wildlife. Olympia, Washington. Available from: http://wdfw.wa.gov/publications/01356/.

WDFW (Washington Department of Fish and Wildlife). 2013. Hatcheries headquarters database. Hatcheries Data Unit, Washington Department of Fish and Wildlife. Olympia, Washington.

WDFW (Washington Department of Fish and Wildlife). 2013. Salmonid stock inventory (SaSI). Fish Program, Science Division. Washington Department of Fish and Wildlife. Olympia, Washington. Available from: http://wdfw.wa.gov/conservation/fisheries/sasi/ .

WDFW (Washington Department of Fish and Wildlife). 2013. 2013/2014 Washington sport fishing rules. Washington Department of Fish and Wildlife. Olympia, Washington. Available from: http://wdfw.wa.gov/publications/01384/wdfw01384.pdf.

WDW (Washington Department of Wildlife), Confederated Tribes and Bands of the Yakima Indian Nation, Confederated Tribes of the Colville Indian Reservation, and Washington Department of Fisheries. 1990. Methow and Okanogan rivers Subbasin, salmon and steelhead production plan. Available from the Northwest Power Planning Council, Portland, OR. WDW 1990

WDOE (Washington Department of Ecology). 2014. Water Resources Explorer. Retrieved July 14, 2014, from: https://fortress.wa.gov/ecy/waterresources/map/WaterResourcesExplorer.aspx.

Wegge, T. 2009. Methods for estimating region economic impacts of Washington hatchery programs: technical memorandum. TCW Economics. Sacramento, California. 10 pp.

Wipfli, M.S., J. Hudson, and J. Caouette. 1998 Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Can J. Fish. Aquat. Sci. 55: 1503-1511.

Attachment 1: WDFW Virology Sampling 2008-2009 through 2012-2013: Cowlitz Hatchery Complex steelhead.

Source: WDFW Fish Health Lab data 2014 (John Kerwin)

Note: For Cowlitz system salmon data, see Cowlitz Chinook and coho HGMPs.

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
COWLITZ T	COWLITZ R	LWSTHD	07/10/08	NEV	diag, 10^{0} – 10^{-2}, whole fry, BP	JUV/08	0710-2			8	3					
COWLITZ T	COWLITZ R	SSTHD	10/15/08	NEV	diag, 10^{0}-10^{-1}	AD	1016-8			17	4					
MERWIN	LEWIS R	SSTHD	12/04/08	**IHNV**	1+/11p OF & 1+/7p K/S , #1-11	AD	1205-1/2	32	11	30	6			ND	E/C	ND
COWLITZ T	COWLITZ R	SSTHD	12/09/08	**IHNV**	10+/12p OF & 7+/12p K/S	AD	1209-4/5	60	12					ND	E/C	ND
MERWIN	LEWIS R	SSTHD	12/11/08	**IHNV**	2+/16p OF & 1+/6p K/S, #12-27	AD	1212-1/2	45	16	24	5			DB	E	02/05/09
MERWIN	LEWIS R	SSTHD	12/16/08	**IHNV**	1+/13p OF, #28-40	AD	1217-9	37	13	42	13			DB	E/C	02/05/09
COWLITZ T	COWLITZ R	WSTHD	12/29/08	**IHNV**	6+/6p OF & K/S	AD	1229-7/8	30	6	9	3			ND	E/C	ND
MERWIN	LEWIS R	WSTHD	12/29/08	NEV	#1-3	AD	1230-9/10	8	3			7	2	ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/12/09	NEV	#4-9	AD	0113-3/4	16	6	1	1					
COWLITZ T	COWLITZ R	WSTHD	01/13/09	**IHNV**	6+/6p K/S	AD	0115-1			1	1					
COWLITZ T	COWLITZ R	WSTHD	01/20/09	**IHNV**	6+/6p OF	AD	0120-3	30	6	36	8			DB	E/C	05/05/09
MERWIN	LEWIS R	WSTHD	01/21/09	**IHNV**	OF #10-17, K/S #10-14	AD	0122-1/2	24	8	1	1					
COWLITZ T	COWLITZ R	SSTHD	01/23/09	**IHNV**	13+/13p K/S	JUV/08	0123-2			1	1					
COWLITZ T	COWLITZ R	SSTHD	02/05/09	**IHNV**	3+/3p K/S	JUV/08	USFWS - 2974			24	5			ND	E/C	ND
COWLITZ T	COWLITZ R	SSTHD	02/05/09	**IHNV**	2+/2p gills	JUV/08	USFWS - 2974			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/16/09	NEV	OF & K/S: 10^{0}-10^{-3}	AD	0417-1/2	1	1	3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/16/09	NEV	male #12, spawned, sample frozen	AD	0501-4			1	1					
COWLITZ T	COWLITZ R	LWSTHD	04/21/09	**IHNV**	7+/8p OF & K/S	AD	0422-1/2	36	8	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/23/09	NEV	male mortality, sample frozen	AD	0430-4			3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/26/09	NEV	male mortality, sample frozen	AD	0430-5			3	2					
COWLITZ T	COWLITZ R	LWSTHD	04/28/09	**IHNV**	5+/5p OF & K/S	AD	0429-2/3	24	5	7	5					
MERWIN	LEWIS R/WILD	WSTHD	04/28/09	NEV	male mortality, fresh	AD	0430-6			3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/29/09	NEV	OF lost in transit, dil w 1ml AB, spawned	AD	0430-1/2	1	1	4	4					
MERWIN	LEWIS R/WILD	WSTHD	04/29/09	NEV	male mortality, fresh	AD	0430-3			2	2					
MERWIN	LEWIS R/WILD	WSTHD	04/30/09	NEV	mortality, #58	AD	0501-5			4	4					
MERWIN	LEWIS R/WILD	WSTHD	05/01/09	NEV	F #23 & M #19 & 39, spawned	AD	0501-2/3	1	1	8	3					
MERWIN	LEWIS R/WILD	WSTHD	05/11/09	NEV	F #63 & M #57 & 40	AD	0513-2/3	1	1	17	4					
MERWIN	LEWIS R/WILD	WSTHD	05/13/09	NEV	F #66-67 & M #17/51, 49/45, 34 (mort)	AD	0514-1/2	2	2	30	6			ND	E/C	ND
MERWIN	LEWIS R/WILD	WSTHD	05/14/09	NEV	F #68 & M #41/55	AD	0515-1/2	1	1					ND	E/C	ND
MERWIN	LEWIS R/WILD	WSTHD	05/19/09	NEV	F #65 & 69, M #46 & 56	AD	0521-1/2	2	2	24	5			DB	E	02/05/09
MERWIN	LEWIS R/WILD	WSTHD	05/21/09	NEV	F #74, M #25	AD	0522-1/2	1	1	42	13			DB	E/C	02/05/09
MERWIN	LEWIS R/WILD	WSTHD	05/26/09	NEV	F #64 & 70, M #73 & 71	AD	0527-2/3	2	2	9	3			ND	E/C	ND
COWLITZ T	COWLITZ R	SSTHD	07/27/09	NEV	diag, rcwy A-3, 10^{0}-10^{-2}	JUV/09	0728-1			6	2					
COWLITZ T	COWLITZ R	SSTHD	07/27/09	NEV	diag, rcwy A-3, 10^{0}-10^{-2}	JUV/09	0728-1			6	2					
MERWIN	LEWIS R	SSTHD	09/17/09	**IHNV**	2+/3 K/S, diag, EPC 10^{0}-10^{-3}	IMM AD	0918-5			3	3					10/08/09
MERWIN	LEWIS R	SSTHD	09/17/09	**IHNV**	2+/3 K/S, diag, EPC 10^{0}-10^{-3}	IMM AD	0918-5			3	3					10/08/09
MERWIN	LEWIS R	SSTHD	11/30/09	**IHNV**	2+/16p OF & 1+/16p K/S	AD	1201-19/20	45	16	45	16			PCR	E/C	12/23/09
MERWIN	LEWIS R	SSTHD	11/30/09	**IHNV**	2+/16p OF & 1+/16p K/S	AD	1201-19/20	45	16	45	16			PCR	E/C	12/23/09
MERWIN	LEWIS R	SSTHD	12/07/09	**IHNV**	2+/13p OF & 2+/5p K/S, #17-29	AD	1208-2/3	39	13	15	5				E/C	
MERWIN	LEWIS R	SSTHD	12/07/09	**IHNV**	2+/13p OF & 2+/5p K/S, #17-29	AD	1208-2/3	39	13	15	5				E/C	
COWLITZ S	COWLITZ R	SSTHD	12/09/09	**REOVIRUS**	1+/12p K/S	AD	1210-11/12	60	12	60	12			F&P	C	01/26/10
COWLITZ S	COWLITZ R	SSTHD	12/09/09	**REOVIRUS**	1+/12p K/S	AD	1210-11/12	60	12	60	12			F&P	C	01/26/10
MERWIN	LEWIS R	SSTHD	12/14/09	**IHNV**	3+/4p OF, #30-33	AD	1215-17	12	4					DB	E/C	01/08/10
MERWIN	LEWIS R	SSTHD	12/14/09	**IHNV**	3+/4p OF, #30-33	AD	1215-17	12	4					DB	E/C	01/08/10

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
COWLITZ T	COWLITZ R	WSTHD	12/28/09	NEV		AD	1229-1/2	20	4	20	4					
MERWIN	LEWIS R	WSTHD	12/28/09	NEV	#1-5	AD	1229-9/10	13	5	13	5					
COWLITZ T	COWLITZ R	WSTHD	12/28/09	NEV		AD	1229-1/2	20	4	20	4					
MERWIN	LEWIS R	WSTHD	12/28/09	NEV	#1-5	AD	1229-9/10	13	5	13	5					
MERWIN	LEWIS R	WSTHD	01/04/10	**IHNV**	1+/1p K/S, #6-9	AD	0105-3/4	12	4	12	4			PCR	E	01/26/10
MERWIN	LEWIS R	WSTHD	01/11/10	NEV	#10, 11	AD	0112-3/4	7	2	7	2					
COWLITZ T	COWLITZ R	WSTHD	01/12/10	**IHNV**	1+/4p OF	AD	0113-3/4	20	4	20	4			PCR	E/C	01/26/10
COWLITZ T	COWLITZ R	WSTHD	01/19/10	NEV		AD	0120-13/14	20	4	20	4					
MERWIN	LEWIS R	WSTHD	01/19/10	**IHNV**	1+/4p OF & K/S, #12-15	AD	0120-3/4	10	4	10	4				E/C	
COWLITZ T	COWLITZ R	WSTHD	01/25/10	NEV		JUV/09	0125-1			60	12					
MERWIN	LEWIS R/WILD	WSTHD	03/17/10	**IHNV**	1+/1p OF & K/S, #12-15	AD	0318-1/2	1	1	1	1			PCR	E/C	04/01/10
MERWIN	LEWIS R/WILD	WSTHD	03/26/10	**IHNV**	1+/1, #12	AD	0326-4			1	1				C	04/20/10
MERWIN	LEWIS R/WILD	WSTHD	04/01/10	NEV	#37	AD	0402-1/2	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/01/10	**IHNV**	1+/1 OF & K/S, #11	AD	0402-3/4	1	1	1	1				E/C	04/14/10
MERWIN	LEWIS R/WILD	WSTHD	04/06/10	NEV	F#52	AD	0407-2/3	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/09/10	NEV	F#56	AD	0409-2/3	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/12/10	NEV	#21, 57, 59	AD	0413-3/4	3	3	3	3					
MERWIN	LEWIS R/WILD	WSTHD	04/13/10	NEV	#44, 51, 66	AD	0414-4/5	3	3	3	3					
MERWIN	LEWIS R/WILD	WSTHD	04/19/10	**IHNV**	5+/5 OF & K/S; #47, 64, 67, 69, 72	AD	0421-2/3	5	5	5	5				E/C	05/21/10
COWLITZ S	COWLITZ R	LWSTHD	04/21/10	**IHNV**	1+/6p OF & K/S	AD	0421-7/8	30	6	30	6			SN	E/C	05/05/10
MERWIN	LEWIS R/WILD	WSTHD	04/26/10	NEV	F#70, 77	AD	0427-4/5	2	2	2	2					
COWLITZ	COWLITZ R	LWSTHD	04/28/10	**REOVIRUS**	K/S: 1+/6P	AD	0428-1/2		6		6				C	06/03/10
MERWIN	LEWIS R/WILD	WSTHD	05/14/10	**IHNV**	2+/3 OF; #88, 95, 99; spawned on Friday, samples frozen over weekend	AD	0518-2/3	3	3	3	3				E/C	06/17/10
COWLITZ S	COWLITZ R	LWSTHD	04/28/10	**REOVIRUS**	1+/6p K/S	AD	0428-1/2	30	6	30	6			F&P	C	06/03/10
MERWIN	LEWIS R	SSTHD	07/15/10	**IHNV**	1+/2p K/S	IMM AD	0716-1			2	2			PCR	E	08/05/10
MERWIN	LEWIS R	SSTHD	11/30/10	NEV	#1-4	AD	1201-1/2	12	4	12	4					
MERWIN	LEWIS R	SSTHD	12/06/10	NEV	#5-8	AD	1206-1/2	10	4	10	4					
COWLITZ T	COWLITZ R	SSTHD	12/08/10	NEV		AD	1208-16/17	60	12	60	12					
COWLITZ T	COWLITZ R	WSTHD	01/05/11	**IHNV**	3+/4p OF & 4+/4p K/S	AD	0105-13/14	20	4	20	4					
MERWIN	LEWIS R	SSTHD	12/13/10	NEV	#9-14	AD	1214-5/6	16	6	16	6					
COWLITZ T	COWLITZ R	WSTHD	01/12/11	**IHNV**	2+/2p OF & 1+/2p K/S	AD	0112-13/14	10	2	10	2				E/C	
MERWIN	LEWIS R	WSTHD	12/29/10	NEV		AD	1229-25/26	15	5	15	5					
MERWIN	LEWIS R	WSTHD	01/05/11	NEV	#6-8, EPC 10^{0}-10^{-2}	AD	0106-7/8	9	3	9	3					
COWLITZ S	COWLITZ R	LWSTHD	02/14/11	NEV	diag, pre spawning mortality,10^{0}-10^{-3}	AD	0215-6			1	1					
MERWIN	LEWIS R	WSTHD	04/01/11	NEV	#22	AD	0402-1/2	1	1	1	1					
COWLITZ S	COWLITZ R	LWSTHD	04/12/11	NEV		AD	0412-2/3	15	3	15	3					
MERWIN	LEWIS R/WILD	WSTHD	04/15/11	NEV	#34	AD	0415-1/2	1	1	1	1					
MERWIN	LEWIS R	SSTHD	12/20/10	**IHNV**	3+/8p OF & 1+/8p K/S, #15-22	AD	1220-5/6	24	8	24	8			DB	E/C	01/04/11
COWLITZ S	COWLITZ R	LWSTHD	04/19/11	NEV		AD	0419-5/6	15	3	15	3					
MERWIN	LEWIS R	WSTHD	01/12/11	**IHNV**	1+/2p OF & K/S, #9-10	AD	0113-4/5	6	2	6	2			S/N		02/25/11
MERWIN	LEWIS R	WSTHD	05/26/11	**IHNV**	Int 6, 10^{0}-10^{-3}, diag	JUV/11	0526-3					15	3	PCR	E/C	
MERWIN	LEWIS R	WSTHD	05/31/11	**IHNV**	10^{0}-10^{-3}, fresh morts	JUV/11	0531-1					20	4			
MERWIN	LEWIS R/WILD	WSTHD	04/11/11	**IHNV**	2+/2p K/S, males, #25-26	AD	0412-1			2	2			DB	E/C	04/26/11
COWLITZ S	COWLITZ R	LWSTHD	04/26/11	NEV	OF: #1-3, 10; K/S: #7-10	AD	0427-2/3	18	4	18	4					
MERWIN	LEWIS R/WILD	WSTHD	04/18/11	**IHNV**	2+/2p OF & K/S; F #13, 27	AD	0419-3/4	2	2	2	2				E/C	
MERWIN	LEWIS R/WILD	WSTHD	04/25/11	**IHNV**	1/3p OF & 3+/9p K/S; F #39, 43, 44 & M #15, 24, 31, 35, 37, 38	AD	0426-1/2	3	3	9	9				E/C	
MERWIN	LEWIS R/WILD	WSTHD	04/28/11	**IHNV**	2+/2p OF & 4+/4p K/S; F #36, 65 & M #23, 28	AD	0429-2/3	2	2	4	4				E/C	

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
MERWIN	LEWIS R/WILD	WSTHD	05/02/11	**IHNV**	1+/1p OF & 1+/3p K/S; F #68 & M #30, 61	AD	0504-8/9	1	1	3	3				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/12/11	**IHNV**	F #31, 50, 66, 74 & M #29, 62, 67, 75	AD	0513-1/2	4	4	8	8				E/C	
MERWIN	LEWIS R/WILD	WSTHD	06/06/11	**IHNV**	2+/2p	JUV/11	WADDL					10	2			
COWLITZ S	COWLITZ R	LWSTHD	05/03/11	NEV	#11-13	AD	0503-1/2	12	3	12	3					
COWLITZ T	COWLITZ R	WSTHD	12/29/10	**IHNV**	2+/6p OF & 4+/6p K/S	AD	1229-21/22	28	6	28	6					01/11/11
MERWIN	LEWIS R	SSTHD	12/29/10	**IHNV**	3+/12p & 2+/12p K/S, #23-34, EPC 10^{0}-10^{-3}	AD	1229-23/24	36	12	36	12				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/16/11	NEV	EPC 10^{0}-10^{-3}; F #84-85 & M #86-87	AD	0517-2/3	2	2	4	4					
MERWIN	LEWIS R/WILD	WSTHD	05/26/11	NEV	healthy, 10^{0}-10^{-1}, from hen 22	JUV/11	0526-1					10	2			
MERWIN	LEWIS R/WILD	WSTHD	05/26/11	NEV	healthy,10^{0}-10^{-1}, from hen 34	JUV/11	0526-2					10	2			
MERWIN	LEWIS R/W	WSTHD	07/21/11	NEV	morts from 1R1, diag 10^{0}-10^{-2}	JUV/11	0722-1					10	2			
MERWIN	LEWIS R/W	WSTHD	07/21/11	NEV	morts from 1R6, diag 10^{0}-10^{-3}	JUV/11	0722-2					5	1			
MERWIN	LEWIS R	SSTHD	11/28/11	NEV	Pools 1-19 have 3 fish, pools 20+21 have 2 fish	AD	1129-5/6	61	21	61	21					
MERWIN	LEWIS R	SSTHD	12/07/11	**IHNV**	#22-39; 2+/18P	AD	1208-3	53	18					DB		12/27/11
MERWIN	LEWIS R	SSTHD	12/12/11	NEV	#40-45, #43 AND 45 ARE 2 FISH/POOL	AD	1213-4	16	6							
COWLITZ T	COWLITZ R	SSTHD	12/15/11	NEV		AD	1216-3/4	60	12	60	12					
MERWIN	LEWIS R	WSTHD	12/28/11	**IHNV**	OF: F#1-5, 4+/5p; K/S: F#1-5, M#1-5, 10+/10p	AD	1230-3/4	14	5	28	10			SN	E/C	1/13/12
MERWIN	LEWIS R	WSTHD	01/04/12	**IHNV**	#6, 7, 8; OF: 3+/3P; K/S: 5+/6P	AD	0105-22/23	9	3	18	6				E/C	
MERWIN	LEWIS R	WSTHD	01/11/12	**IHNV**	OF:#9-12, 1+/4P; K/S: F#9-12, M#9-10, 3+/6P	AD	0112-5/6	10	4	14	6					
COWLITZ T	TILTON R/W	LWSTHD	03/27/12	NEV		AD	0328-7	1	1							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	03/27/12	NEV		AD	0328-8	2	1							
COWLITZ T	TILTON R/W	LWSTHD	04/03/12	NEV	Diag 10^{0}-10^{-3}	AD	0405-3	1	1							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/03/12	NEV	Diag 10^{0}-10^{-3}	AD	0405-4	2	1							
MERWIN	LEWIS R/W	LWSTHD	04/10/12	**IHNV**	OF: TN-9, 1+/1P; K/S: TN-2, 1+/1P	AD	0411-9/10	1	1	1	1			SN	E/C	4/23/12
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/11/12	NEV		AD	0411-13	2	1							
COWLITZ T	COWLITZ R	LWSTHD	04/16/12	NEV		AD	0417-4/5	28	6	30	6					
MERWIN	LEWIS R/W	LWSTHD	04/17/12	**IHNV**	OF: #2-5; K/S: TN#8,11, 12,13, 3+/4P	AD	0419-1/2	4	4	4	4				E/C	
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/18/12	NEV		AD	0419-7	3	3							
COWLITZ T	COWLITZ R	LWSTHD	04/24/12	**IHNV**	OF: 1+/7P; K/S: 1+/6P	AD	0426-2/3	32	7	30	6			PCR	E/C	5/11/12
COWLITZ T	TILTON R/W	LWSTHD	04/24/12	NEV		AD	0426-4	3	3							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/24/12	**IHNV**	1+/3P	AD	0426-5	11	3					PCR	E/C	5/11/12
MERWIN	LEWIS R/W	LWSTHD	04/25/12	**IHNV**	OF: #6, 7, 1+/2P; K/S: TN#22, 30, 39, 43, 3+/4P	AD	0427-3/4	2	2	4	4				E/C	
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/02/12	NEV		AD	0504-1	2	2							
COWLITZ T	TILTON R/W	LWSTHD	05/02/12	**IHNV**	2+/5P	AD	0504-2	5	5					PCR	E/C	5/18/12
MERWIN	LEWIS R/W	LWSTHD	05/02/12	**IHNV**	OF: #8, 9, 2+/2P; K/S: TN#66, 69, 2+/2P	AD	0504-3/4	2	2	2	2					
MERWIN	LEWIS R/W	LWSTHD	05/03/12	**IHNV**	OF: #10 (F#02163), NEV; K/S: TN#44, 40, 2+/2P	AD	0504-5/6	1	1	2	2					
MERWIN	LEWIS R/W	LWSTHD	05/08/12	**IHNV**	OF: #11-15, 5+/5P; K/S: TN#32, 33, 41, 64, MT#3, 2+/5P	AD	0510-1/2	5	5	5	5				E/C	
MERWIN	LEWIS R/W	LWSTHD	05/09/12	**IHNV**	OF: #16; K/S: TN#19, 28, 2+/2P	AD	0510-3/4	1	1	2	2				E/C	
COWLITZ T	UPPER COWLITZ R/ W	LWSTHD	05/09/12	NEV		AD	0510-5	6	6							
COWLITZ T	TILTON R/W	LWSTHD	05/09/12	NEV		AD	0510-6	2	2							
MERWIN	LEWIS R/W	LWSTHD	05/14/12	**IHNV**	OF: #17, 1+/1P; K/S: TN#29, 1+/1P	AD	0515-1/2	1	1	1	1				E/C	
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/16/12	**IHNV**	#1-7; 3+/7P	AD	0518-4	7	7							
COWLITZ T	TILTON R/W	LWSTHD	05/16/12	**IHNV**	#1-4; 3+/4P	AD	0518-5	4	4							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/23/12	**IHNV**	1+/1P	AD	0523-2	1	1							
MERWIN	LEWIS R/W	LWSTHD	05/29/12	**IHNV**	OF: TN-72 1+/1P; K/S: MT-7,10 1+/2P	AD	0530-3/4	1	1	2	2					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/29/12	NEV		AD	0531-3	1	1							
MERWIN	LEWIS R	SSTHD	11/28/12	NEV	OF: #1-15, No #3 or #4	AD	0103-21/22	12	5	23	5					
MERWIN	LEWIS R	SSTHD	12/03/12	NEV	OF: #16-22 K/S: #10-12	AD	0110-9	6	2							
COWLITZ T	COWLITZ R	SSTHD	12/12/12	**IHNV**	OF: 6+/6P; K/S 2+/6P	AD	0327-15	2	1							E/C

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
COWLITZ S	COWLITZ R	SSTHD	12/19/12	**IHNV**	OF: 6+/6P; K/S 1+/6P	AD	0403-12	1	1							E/C
MERWIN	LEWIS R	WSTHD	01/02/13	NEV	OF: #8-12	AD	0409-9	3	1							
MERWIN	LEWIS R	WSTHD	01/09/13	NEV	#13,14	AD	0409-8	3	1			30	6			
COWLITZ	TILTON WILD	WSTHD	03/26/13	**IHNV**	1+/1P	AD	0411-1	1	1							
COWLITZ T	COWLITZ R	LWSTHD	04/02/13	**IHNV**	1+/1P	AD	0417-8	2	1							
COWLITZ T	TILTON R WILD	LWSTHD	04/08/13	**IHNV**	1+/1P	AD	0417-6/7	35	7	35	7					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/08/13	**IHNV**	1+/1P	AD	0419-1	1	1							
MERWIN	LEWIS R	LWSTHD	04/10/13	NEV	MT-5	AD	0424-4	4	1							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/16/13	**IHNV**		AD	0424-3	2	1							
COWLITZ T	COWLITZ R/H	LWSTHD	04/17/13	**IHNV**		AD	0424-2	25	5							
MERWIN	LEWIS R	LWSTHD	04/18/13	NEV	TN-19	AD	0430-3	5	1							
COWLITZ	UPPER COWLITZ R	LWSTHD	04/22/13	**IHNV**		AD	0430-4	9	2							
COWLITZ T	TILTON R WILD	LWSTHD	04/22/13	**IHNV**		AD	0430-1	5	5							
COWLITZ T	COWLITZ R/H	LWSTHD	04/23/13	**IHNV**		AD	0430-2			25	5					
COWLITZ T	TILTON R WILD	LWSTHD	04/29/13	**IHNV**	1+/1P	AD	0507-4	8	2							E/C
COWLITZ T	UPPER COWLITZ R/ W	LWSTHD	04/29/13	**IHNV**	2+/2P	AD	0507-5	1	1							E/C
MERWIN	LEWIS R	WSTHD	04/29/13	NEV	#1 orange 100, #2 pit tag#5 699E75, #3 orange 99, #4 white 257, #5 orange 19	AD	0508-1	1	1							E/C
COWLITZ T	COWLITZ R/H	LWSTHD	04/30/13	**IHNV**	5+/5P	AD	0514-2	1	1							E/C
COWLITZ T	TILTON R WILD	LWSTHD	05/06/13	**IHNV**	2+/2P	AD	0514-1	2	1							E/C
COWLITZ T	TILTON R WILD	LWSTHD	05/06/13	**IHNV**	1+/1P	AD	0522-4	4	1							E/C
MERWIN	LEWIS R/ W	WSTHD	05/06/13	**IHNV**	1+/1P, TN-29	AD	3701 usfws	1	1							E/C
COWLITZ T	TILTON R WILD	LWSTHD	05/13/13	**IHNV**	1+/1P	AD	1227-13/14	19	7	37	8					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/13/13	**IHNV**	1+/1P	AD	0103-21/22	12	5	23	5					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/21/13	**IHNV**		AD	0110-9	6	2							
COWLITZ T	TILTON R WILD	LWSTHD	05/28/13	**NEV**	sent to usfws lab to run	AD	0327-15	2	1							E/C
MERWIN	LEWIS R	WSTHD	12/26/13	NEV		AD	0403-12	1	1							E/C

14 SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

15 ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2).

15.1 List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> "*The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys...*"

15.2 Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Several USFWS listed and candidate species are found in Cowlitz County, however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

Listed or candidate species:
"No effect" for the following species:

Bull trout (*Salvelinus confluentus*) – Threatened (Critical Habitat Designated)
Nelson's checker-mallow (*Sidalcea nelsoniana*) –Threatened
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened (Critical Habitat Designated)
Columbian White-Tailed deer (*Odocoileus virginianus leucurus*) – Endangered
Gray Wolf (*Canis lupus*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened (Critical Habitat Designated)

Candidate Species
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS

15.3 Analyze effects.

Not applicable.

15.4 Actions taken to minimize potential effects.

Program steelhead are released fully smolted to foster rapid outmigration from the basin and to minimize predation and residualism risks.

15.5 References

Not applicable.

16 "Take" Tables

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook (*Oncorhynchus tshawytscha*) Steelhead *(Oncorhynchus mykiss*) Coho (*Oncorhynchus kisutch*) Chum (*Oncorhynchus keta*)	**ESU/Population:** Lower Columbia River Chinook Lower Columbia River Steelhead Lower Columbia River Coho Columbia River Chum	**Activity:** Cowlitz Summer Steelhead Program
Location of hatchery activity: Cowlitz Trout Hatchery/Cowlitz River (RKm 66)	**Dates of activity:** December-May	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass	TBD	TBD	TBD	TBD
Collect for transport	TBD	TBD	TBD	TBD
Capture, handle, and release	TBD	TBD	TBD	TBD
Capture, handle, tag/mark/tissue sample, and release	TBD	TBD	TBD	TBD
Removal (e.g. broodstock)	TBD	TBD	TBD	TBD
Intentional lethal take	TBD	TBD	TBD	TBD
Unintentional lethal take	TBD	TBD	TBD	TBD
Other Take (specify)	TBD	TBD	TBD	TBD

Take Tables to be submitted to NOAA-NMFS, in progress. Will include monitoring activities